

**THIS EDITION'S FEATURE ARTICLES:**

- **FIELD EVALUATION AND MANAGEMENT OF NON-BATTLE RELATED KNEE AND ANKLE INJURIES BY THE ATP IN THE AUSTERE ENVIRONMENT: PART THREE**
- **NATO SOF TRANSFORMATION AND THE DEVELOPMENT OF NATO SOF MEDICAL DOCTRINE AND POLICY**
- **DAMAGE CONTROL RESUSCITATION FOR THE SPECIAL FORCES MEDIC – SIMPLIFYING AND IMPROVING PROLONGED TRAUMA CARE: PART ONE**
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- **BRAIN NATRIURETIC PEPTIDE LEVELS IN SIX BASIC UNDERWATER DEMOLITIONS/SEAL RECRUITS PRESENTING WITH SWIMMING INDUCED PULMONARY EDEMA (SIPE)**

**Dedicated to the Indomitable Spirit & Sacrifices of the SOF Medic**

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To qualify for 1 CME, it must take 60 min to both read the article and take the accompanying test. To accomplish this, your articles need to be approximately 12 – 15 pages long with a 10 – 15 question test. The JSOM continues to survive because of the generous and time-consuming contributions sent in by physicians and SOF medics, both current and retired. See Submission Criteria in the back of this journal. We are looking for SOF-related articles from current and/or former SOF medical veterans. We want articles that deal with trauma, orthopedic injuries, infectious disease processes, and/or environment and wilderness medicine. Mostly, we need you to write CME articles. Help keep each other current in your re-licensure requirements. Don't forget to send photos to either accompany the articles, or alone to be included in the Photo Gallery associated with medical guys and/or training. If you have contributions great or small... send them our way. Our e-mail is: [JSOM@socom.mil](mailto:JSOM@socom.mil).

Lt Col Michelle DuGuay Landers

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# Field Evaluation and Management of Non-Battle Related Knee and Ankle Injuries by the ATP in the Austere Environment — Part Three

JF Rick Hammesfahr, MD

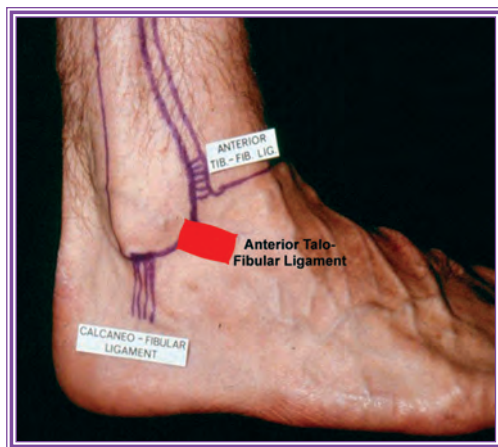
**Editor's Note:** Part Three consists of ankle injury evaluation and taping.

Part Two (taping procedures for the various knee injuries) was published in the *JSOM* Spring 09, Vol 9 Ed 2.

Part One (evaluation of knee injuries) was published in the *JSOM* Winter 09, Vol 9 Ed 1.

## ANKLE

The most commonly injured ankle ligament is the anterior talo-fibular ligament (ATFL) located at the anterolateral aspect of the ankle (Figure 58).



**Figure 58:** Anterior talo-fibular ligament location at the anterolateral aspect of the ankle.

With respect to ankle sprains and injury to the ATFL, the typical mechanism of injury involves a forced motion that is best described as a plantarflexion – inversion deforming force (Figure 59).

This injury is often accompanied by a history of a pop; the patient often states that they rolled their ankle; there is pain and swelling with the most intense area of symptoms located at the anterolateral aspect of the ankle.



**Figure 59:** Plantarflexion and inversion of the ankle leads to abnormal stretching and tearing of the anterior talo-fibular ligament (ATFL).

When intact, the ATFL goes from the distal aspect of the fibula to the talus. In this position, it acts as a checkrein to prevent abnormal posterior subluxation of the tibia relative to the talus (Figure 60).



**Figure 60:** Intact ATFL prevents subluxation of the tibia and fibular complex relative to the talus.



In testing for stability of the ATFL, which is a major stabilizer of the ankle, an anterior drawer test is performed. This is done much like the anterior drawer test of the knee. The knee is flexed to 90 degrees and the foot is stabilized (Figure 61). By applying an anteriorly directed force to the calcaneus, or by stabilizing the foot, and then applying a posteriorly directed force to the tibia, the stability of the lateral ankle ligaments are tested.



**Figure 61:** Anterior drawer test of the ankle. With a posteriorly directed force applied to the tibia, and with the foot stabilized, there is no subluxation of the tibia and fibula posterior on the talus.

If the ATFL is torn, the tibia and fibula will sublux posteriorly (Figure 62 and 63). It should be noted that this test should always be performed with the knee flexed. With the knee extended, there is false stability when doing the test.



**Figure 62:** Torn ATFL with posterior tibia and fibular subluxation on the talus after applying a posteriorly directed force.



**Figure 63:** Torn ATFL with posterior tibia and fibula subluxation. Although xray stress views are shown for teaching purposes, the posterior “clunk” as the bones sublux is readily felt and may be visualized in most patients.

The treatment for an ankle sprain is to prevent the deforming forces of plantarflexion and inversion. This is performed by taping the ankle followed by administration of non-steroidal anti-inflammatory medication. Further evaluation upon return to base is absolutely required. Most likely the mission can be completed.

#### ANKLE TAPING

Just as with the knee, the taping at the ankle begins with applying anchoring strips. The anchoring strips are usually overlapped by approximately 30-50%. This taping method is demonstrated using two colors of tape so that the overlap and position of the tape may be better appreciated. As with taping the knee, the skin should be clean and dry. If possible, shave the hair prior to tape application. However, tape should NOT be applied over open wounds.

Start by placing the ankle in the neutral position, perpendicular to the lower leg (Figure 64).



**Figure 64:** Start with the ankle perpendicular to the foreleg and everted if possible.

The circumferential anchoring strips are applied with approximately a 30%-50% overlap (Figure 65). Strips are applied at the metatarsal phalangeal region distally as well as approximately half way up the foreleg.



**Figure 65:** Proximal and distal anchoring strips.

Following the basic anchoring strips, U-shaped strips are applied. When applying these strips, start proximally and medially. As the tape is applied, the hindfoot is pulled into eversion, to decrease the stress on the damaged ATFL region. This allows for stability of the ankle with respect to inversion and eversion (Figure 66 and 67).



**Figure 66:** Pull tape strips from medial to lateral to evert the hindfoot.



**Figure 67:** Second hindfoot anchoring strip applied.

After two of these strips have been applied, U-shaped strips are applied beginning at the medial aspect of the foot and then continuing posterior to the ankle, ending at the distal lateral aspect of the foot. This aids in stability of forefoot adduction and aids in stability of inversion (Figure 68 and 69).



**Figure 68:** Initial horizontal foot/ankle anchoring strip.



**Figure 69:** Second horizontal foot/ankle anchoring strip.



After completion of these two strips, the anchoring strips (or heel lock taping) to specifically resist inversion are applied. The tape is started at the medial aspect of the ankle (Figure 70).



**Figure 70:** Start at the proximal medial ankle with the heel lock tape strip.

Pull the tape across the plantar aspect of the heel (Figure 71),



**Figure 71:** Plantar application of the heel lock.

As the tape is pulled proximally and laterally across the lateral border of the heel and ankle, the heel and ankle should be everted to further increase the efficiency of the heel lock tape strip and thereby decrease any stress on the injured ATFL region (Figure 72).



**Figure 72:** Pull the ankle into eversion as the tape is applied to the lateral border of the heel and ankle.

Finally, continue to pull the heel into eversion as the tape is pulled to the medial side of the foreleg (Figure 73).



**Figure 73:** Completed application of the heel lock tape strip.

The heel lock tape strip essentially pulls the ankle into a position of eversion which takes the stress off the damaged ligaments. Once the first heel lock strip is applied, three or four more are then placed (Figure 74-76).



**Figure 74:** Completion of second heel lock strip.



**Figure 75:** Starting the third heel lock strip.



**Figure 76:** Completion of four heel lock strips.

Once these strips have been applied, additional circumferential strips are applied (Figure 77).



**Figure 77:** Circumferential anchoring strips applied to the foreleg and foot.

In doing so, all the skin is closed and covered with tape with the exception of the open area at the heel. This is done because ankle injuries are associated with a lot of swelling. If there are any breaks in the tape and if skin is allowed to “peek” through the tape, this area will develop a very painful tape blister, which in the austere environment runs the risk of becoming infected (Figure 78).



**Figure 78:** Complete taping with the heel left open.

This type of taping results in excellent stability of the ankle joint. Obviously, the patient cannot return to totally normal activities although he should remain functional.

To appreciate the amount of stability that taping provides, look at the amount of inversion possible in the untaped ankle (Figure 79) as opposed to the taped ankle (Figure 80).



**Figure 79:** Significant inversion of untaped ankle.



**Figure 80:** *Minimal inversion of taped ankle as determined by inability to invert ankle/foot and raise the 1st MTP joint off of the floor.*

### GENERAL PRINCIPLES AND GUIDELINES

In trying to anticipate return to activity, ideally there is no swelling or effusion, the patient has full range of motion and approximately 90% of normal strength. However, the treating ATP must be aware that as swelling decreases, the pain decreases and the motion increases. This gives a very false sense of healing. In fact, the symptoms will often disappear approximately four weeks prior to completion of healing. Obviously, this sets up the situation whereby the patient is relatively asymptomatic, the healing is immature and not complete, and a premature return to activity leads to an extremely high re-injury rate.

In general, successful treatment of non-battlefield related knee and ankle injuries, in the austere situation, so that the patient may remain functional, requires several things:

- The ATP must understand the anatomy involved.
- He must know the questions to ask to identify the mechanism of injury.
- The ATP must understand the taping principles.
- He must recognize that the taping is designed to support the injured tissue and decrease the stress load on the injury. To determine the type of taping and to apply it successfully, it is obviously necessary to have a high probability of a working diagnosis.
- He must know the possible diagnoses affecting a joint given a set of physical findings and a mechanism of injury
- Most importantly, a minimum of six weeks of healing is required, regardless of what the patient says or how the patient feels.
- The absence of pain does not equal healing
- All of the injuries discussed here are significant injuries that absolutely require further medical evaluation upon return to base.

### REFERENCE

Perrin, David. (2005). Taping and Bracing, Human Kinetics.

**This completes our three-part series.**



JF Rick Hammesfahr, M.D. graduated from Colgate University in 1973 and the College of Medicine and Dentistry of New Jersey in 1977. He was Chief Resident in Orthopaedics at Emory University from 1980-1982. In addition to receiving numerous surgical awards, he has been on the speaking faculty of numerous medical and orthopaedic meetings serving as the co-director of several courses on knee surgery. His publications have focused on tactical medicine, arthroscopy, calcaneal fractures, abductor paralysis, wound healing, running injuries, meniscal repair, septic knees, and sports medicine. He has written two book chapters, one book, published 22 articles, serves on the editorial review board of multiple medical journals, is a chief editor of the "Ranger Medic Handbook," and has presented over 120 CME lectures and talks on orthopedics and sports injuries.

Dr Hammesfahr has served as president of the largest regional orthopaedic association, the Southern Orthopaedic Association. Currently, he is the Director of the Center for Orthopaedics and Sports Medicine and serves as the Chairman of the USSOCOM Curriculum and Examination Board.



# NATO SOF Transformation and the Development of NATO SOF Medical Doctrine and Policy

G. Rhett Wallace, MD, FAAFP

## ABSTRACT

The North Atlantic Treaty Organization (NATO) Special Operations Forces (SOF) Coordination Center (NSCC) is a new NATO memorandum of understanding (MOU) organization that is effecting rapid advancement in NATO's ability to efficiently utilize SOF at the strategic/operational level. The NSCC's lines of development in communications information systems (CIS), education, training, and real life support to the International Security Assistance Force (ISAF) SOF and the development of pivotal documents to develop and mature NATO SOF doctrine and policy are all occurring at lightning speed. Within this process of establishing a SOF community in NATO, the author's focus is the development of previously non-existent NATO SOF medical doctrine and policy. Many barriers to change lie ahead, but through unity of effort, we will ensure certainty of our actions.

The focus of this article is to give a brief overview of the development of the NATO SOF Transformation Initiative (NSTI), highlight the establishment of the NSCC, and discuss the development of NATO SOF medical doctrine and policy that will shape how NATO SOF operations are medically planned and supported in current and future operations.

The NSTI concept began in the spring of 2006 as a multinational call to the Supreme Allied Commander Europe (SACEUR), the commanding officer of NATO's Allied Command for Operations (ACO), Supreme Headquarters Allied Powers Europe (SHAPE). Several nations saw a need to develop a SOF capability for NATO, addressing gaps in NATO's ability to strategically and operationally employ national SOF elements in a cohesive alliance or coalition environment.

While NATO is established in accordance with Article 51 of the United Nations Charter as a political alliance with a military branch organized for collective defense, NATO's focus has historically been based on the *conventional* aspects of the alliance's military power. Because of this, NATO's motivations for change were the identified gaps in its "response to *unconventional* threats that recognize no national boundaries, show open contempt for human rights, and international rule of law."<sup>1</sup> As a result, in November 2006, at the Riga Summit in Latvia, President George W. Bush, as the Dean of the North Atlantic Council (NAC), announced the NAC's endorsement of the NSTI, with the NSCC, frame-worked by the United States, as the centerpiece.<sup>2</sup>

The NSCC was established as a coordination center under a memorandum of understanding (MOU) to streamline its development and implementation. The United States volunteered to be the framework nation, with Vice Admiral William McRaven, then the Commander, Special Operations Command Europe (SOCEUR), in Stuttgart, Germany, as its first "dual-hatted" Director. With an initial cadre of 17 personnel selected from the SOCEUR Joint Staff, the intent was to build the NSCC at Stuttgart, where it would remain for three to five years before relocating to SHAPE. However, realignment of organizations at SHAPE allowed the NSCC to transfer much earlier than expected, and in the summer of 2007, it was moved to SHAPE. Today, the NSCC has a staff of 110 multinational personnel, having reached initial operational capability in August, 2008, with full operational capability expected by the end of May 2009, along with the arrival of another 32 personnel. Most recently, as a result of the NATO Summit in Strasbourg, the NSCC has been tasked to plan for a way ahead to move beyond a coordination center and to establish a full SOF headquarters for NATO.

The mission of the NSCC is to enable and support NATO Special Operations Forces as the focal point for strategic SOF advice and operational planning to the NATO chain of command. This is accomplished by providing subject matter expertise to the SACEUR and Joint Force Commands (JFCs) and translating strategic estimates into operational requirements. In addition, the NSCC is responsible for coordination and synchronization of NATO SOF in the

force generation process, the development of NATO SOF policy and doctrine, and fostering interoperability and standardization. In the area of interoperability, the NSCC focuses on NATO SOF education, training, and exercises.<sup>3</sup>

The NSCC is aggressively accomplishing the goals outlined by the NAC and Military Committee. Initial NATO SOF operational concepts at the strategic and operational level were developed in the NSCC Handbook, and formalized in the development and ratification of the Military Committee's documentation of NATO SOF Policy and Allied Joint Publication (AJP) 3.5.<sup>4,5</sup> Through these foundational documents, NATO has set the framework for development of a SOF structure, doctrine, and policy. As one would expect, the complexities of coordinating SOF from 23 different nations' calls for concentrating on the basics. With this in mind, the missions of NATO SOF are very straightforward.<sup>6</sup>

#### **1. SPECIAL RECONNAISSANCE AND SURVEILLANCE (SR)**

SR complements national and Allied theater intelligence collection assets and systems by "obtaining specific, well-defined, and possibly time-sensitive information of strategic or operational significance." It may complement other collection methods where constraints are imposed by weather, terrain-masking, hostile countermeasures or other systems availability. SR is a predominately Human Intelligence (HUMINT) function that places "eyes on target" in hostile, denied, or politically sensitive territory. SOF can provide timely analysis by using their judgment and initiative in a way that technical intelligence, surveillance, target, acquisition, and reconnaissance (ISTAR) cannot. SOF may conduct these tasks separately, supported by, or in conjunction with, or in support of other component commands. They may use advanced reconnaissance and surveillance techniques, equipment, and collection methods, sometimes augmented by the employment of indigenous assets.

#### **2. DIRECT ACTION (DA)**

These are precise operations that are normally limited in scope and duration. They usually incorporate a planned withdrawal from the immediate objective area. DA is focused on "specific, well-defined targets of strategic and operational significance, or in the conduct of decisive tactical operations." SOF may conduct these tasks independently, with support from conventional forces, or in support of conventional forces.

#### **3. Military Assistance (MA)**

MA is a broad spectrum of measures in support of friendly forces throughout the spectrum of conflict. MA can be conducted "by, with, or through friendly forces that

are trained, equipped, supported, or employed in varying degrees by SOF." The range of MA is thus considerable and may vary from providing low-level military training or material assistance to the active employment of indigenous forces in the conduct of major operations.

#### **4. OTHER MISSIONS**

Other missions include, but are not limited to, supporting counter-irregular threat activities, countering chemical, biological, radiological, and nuclear (CBRN) weapons, hostage release operations, and faction liaison.

In order to manage the wide range of missions and requirements, one of the first things the NSCC addressed was the lack of a common CIS by developing and fielding a NATO SOF common CIS network. Fortunately, an existing system, called the Battlefield Information Collection and Exploitation System (BICES), was already available within NATO. Intended to be used for the intelligence community, BICES proved itself as an ideal means for further expansion to support of NATO SOF operational activities. Because BICES has a NATO Secret and Unclassified version, it is ready-made as a system for collaboration of all allied or coalition SOF. In addition, BICES offers the ability to allow non-NATO nations to participate, enabling an even greater fusion of intelligence, and wider synchronization of operations. The development of hardware, software, and deployable container packages for NATO SOF is now ongoing. The intent is to expedite fielding to the ISAF SOF Headquarters in Afghanistan, supporting the already established ISAF SOF Fusion Cell.

On the interoperability front, the NSCC is addressing standardization and interoperability of international SOF by the development of NATO SOF Staff Officers Course, NATO SOF Combined Joint Forces Special Operations Component Command (CJFSOCC) Planners Course, NATO SOF Intelligence Course, a NATO Special Operations Air Planners Course, and the NATO ISAF Pre-trainer Course. These courses are augmented by products such as the CJFSOCC and Special Operations Task Group (SOTG) Handbooks. These handbooks cover the organization and staff functions within the CJFSOCC and at the SOTG level, their relationship to other commands, and liaison roles and responsibilities. Other areas covered include SOF planning, information operations, air support, targeting, battle tracking, intelligence, logistics, Force Health Protection (FHP), and communications. They provide tools for developing a common understanding of the CJFSOCC and SOTG structure, implementation, responsibilities, and procedures within the Combined Joint Task Force (CJTF) construct. As NATO SOF contributes to

current and future operations, these tools will cultivate future development of NATO SOF doctrine and policy.

To understand the basis for the foundational work in developing NATO SOF medical doctrine, we must first understand NATO conventional medical support, and the gaps in NATO's conventional health service support (HSS) and FHP. NATO medical doctrine can be reviewed in depth in AJP 4.10 and MC 326/2.<sup>7</sup> NATO FHP is a patriarchal system primarily organized around fixed medical treatment facilities (MTFs) based on Allied Nations HSS provided to NATO operations. NATO defines roles of medical care as:

**Role 1** is the lowest level at which a physician treats casualties. Role 1 provides advanced trauma/tactical medical care to stabilize and prepare casualties for evacuation to Role 2/3.

**Role 2** is the first level at which damage control surgery (DCS) is performed. Role 2 has two sub-categories: Role 2 Enhanced (Role 2E) – a “mobile” MTF that it is put in place, but a logistical burden to move once in place, and Role 2 Light Maneuver (Role 2LM) – again a “mobile” DCS capability intended to support Infantry or SOF. However, National Role 2LM is often too heavy and immobile to adequately support infantry or SOF advancing on maneuvers.

**Role 3** is the level at which primary surgery is located, and typically has advanced or sub-specialty surgical services associated. Role 3 MTFs generally provide area support within a Joint Operational Area (JOA).

**Role 4** is generally a national fixed MTF.

NATO has standardization agreements (STANAGs)<sup>8</sup> and allied medical publications (AMedP)<sup>9</sup> that address medical standards for individual training and equipment. These are currently being updated and specifically identify or limit doctors as the personnel to be trained with advanced medical techniques. AMedP-17 is the first NATO publication to recognize the term “medic,” and apply it to non-credentialed providers. Medic is not a formal definition in Allied Administrative Publication-6 (AAP-6).<sup>10</sup> For example, Annex A2<sup>11</sup> outlines what medical procedures “Independent medics” may perform; these are by exception restricted to non-invasive techniques. Annex B<sup>12</sup> refers to “doctors” when outlining minimum requirements for medical training of medical personnel. Within NATO's policies on individual training, many contributing nations do not have civilian equivalent “medical providers” outside of credentialed doctors or nurses. This highlights variations in acceptable standards of care within NATO; for example, Nation “X” records reservations to AMedP-

17 stating “medical and surgical treatment techniques can only be applied by physicians.”<sup>13</sup>

As the Senior Medical Advisor (MEDAD) for the NSCC, the author is working to establish a common description of NATO SOF medical capability, defining SOF medical doctrine and policy, developing a “scope of practice” for SOF medics, and to provide guidance to promote the highest quality, evidence-based healthcare within NATO SOF. By defining NATO SOF medical professionals, and providing a definition for standardized SOF medical capability, the author is striving to establish standards for NATO SOF medical professionals to meet relative to educational preparation, professional standing, and technical ability. These standards are met, in part, by the application for – and maintenance in good standing of – a license or certificate in nations that have civilian equivalent medical care providers, and/or a NATO SOF Advanced Tactical Provider (ATP) type registration based on the proposed “scope of practice,” along with the ACO MEDAD and the Committee of the Chiefs of Military Medical Services (COMEDS) guidance on common medical standards and clinical governance in NATO.<sup>14</sup>

The author defines NATO SOF medical professional individual tasks using the Battle Focus Training model, basing essential core tasks on the unit's Mission-Essential Task List (METL). AJP 3.5 and MC 437/1 provide the definition for NATO SOF elements, and authorize missions SOF will conduct under the alliance. NATO SOF are specially organized, trained, and equipped military forces to achieve military strategic or operational objectives by unconventional military means in hostile, denied, or politically sensitive areas. These operations are conducted across the full range of military operations, independently or in conjunction with conventional forces. Political-military considerations often shape SOF operations, requiring discreet, covert, or low visibility techniques that may include operations by, with, and through indigenous forces.

SOF operations differ from conventional operations in the degree of physical and political risk, operational techniques, modalities of employment, and independence from friendly support. Due to the nature of NATO SOF operating in remote, austere, at times primitive conditions, at the operational extremes, outside of conventional forces direct or indirect support, SOF Soldiers and SOF medical professionals should possess and maintain medical skills equal to and above those required to support conventional forces. It is critical that SOF Soldiers and SOF medical professionals be fully trained initially, and have robust medical sus-



tainment training programs on a broad spectrum of primary and emergency medical care techniques, as well as, preventive medicine, zoonotic and parasitic diseases, veterinarian care, dental care, CBRN, advanced trauma, pharmacology, life saving or sustaining invasive surgical and anesthesia techniques. These skills are essential to provide adequate medical force protection support for NATO SOF, and are the basis for promoting SOF medical professional standardized training and promoting interoperability of capability and medical equipment.

Once established, NATO SOF medical training guidance will identify the essential components for individual and collective medical training. Due to the broad definition of SOF, specific SOF units will have different training needs and requirements based on environment, location, equipment, dispersion, and similar factors. SOF operating in a variety of environments, such as hypo/hyperbaric conditions, extremes of heat and cold, mountains or high altitude, should augment the unit level medical training plan to account for medically relevant and specific diagnosis and treatments. Therefore, the SOF medical training guidance should be used as a guide for conducting unit training, not as a rigid standard, and designed to assist the commanders in preparing a SOF unit medical training plan which satisfies integration, cross-training, interoperability, and sustainment training requirements for NATO SOF medical professionals.

Within the past 10 years, SOF Lessons Learned has contributed to advancement in medical care from point of injury to primary surgery.<sup>15</sup> Advances, such as SOF tactical combat casualty care (SOF TCCC) training, SOF individual first aid kits (SOF IFAKs),<sup>16</sup> and development of SOF evacuation kits to create casualty evacuation (CASEVAC) platforms out of transportation of opportunity to get casualties in austere environments to DCS, have been pivotal in reducing died of wounds (DOW) rates for SOF Soldiers.<sup>17</sup> These advances are critical to providing adequate SOF HSS. Promoting the understanding that advanced training and modernized equipment such as the single handed tourniquet and haemostatic bandages for hemorrhage control is good, but DCS or primary surgery is still required to address non-compressible hemorrhage to complete adequate SOF HSS for SOF casualties. Often conventional Role 2/3 is unable to meet SOF HSS requirements due to the great distance or the inflexibility of conventional structures to adapt to rapidly changing requirements; other issues revolve around non-existent/inadequate

host national medical support. SOF requires flexible innovative medical planners to accommodate for gaps in capability. In light of this recurring issue multiple nations have or are developing a Role 2 ultra-LM element that provides a truly light, maneuverable surgical and critical evacuation team who are familiar with SOF mission sets, tactics and techniques, are operationally ready, small and light enough to maneuver with SOF, and under the command and control (C2) of the SOF Command. The author defines this capability as Role 2 Special Operations Surgical/Evacuation Team (Role 2 SOST).

NATO comprehensive political guidance projects an environment of change that “is and will be complex and global, and subject to unforeseeable developments.”<sup>18</sup> SOF missions and operational concepts are conducted across the range of military operations through peacetime, conflict, various stages of war, and Article 5 collective defense or non-Article 5 Crisis Response Operations. The SOF TCCC depends on an enhanced capability for first responders, SOF Combat Medic (SOCMs), SOF medical providers (SFMPs), and adaptive standard and non-standard platforms for CASEVAC in emergencies. Patients are CASEVAC’d to the nearest host nation or Role 2/3 MTF capability, but SOF TCCC capabilities are of little benefit if there is no timely resuscitative surgical care available.

As defined earlier, SOF operations by nature are remote, austere, and in primitive conditions at operational extremes outside of conventional forces or friendly direct or indirect support. SOF operate in small teams and are often cross-trained in multiple skill sets to ensure economy of effort and redundancy of capability. Advanced first responder training is essential for all SOF Soldiers. It is imperative that all SOF Soldiers be cross-trained as medical first responders.

SOF medical professionals can include a wide range of medical and paramedical professions. The following descriptions are included to assist in understanding the capability that each medical professional provides as a combat multiplier.

NATO in general does not specifically define the “medic.” Conventional medics have the skill sets to provide emergency care and entry level nursing care for patients. They attend a military/civilian medical training program that provides them with a certification (national or military) to provide medical care within their scope of practice. Course content usually includes, but is not limited to, trauma management, pre-hospital trauma management and care, basic life support (BLS), advanced life support (ALS), and inpatient nursing skills. They can perform basic medical care under the supervi-

sion of a physician, and limited preventive medicine. They can directly support combat units, ambulance teams, or Role 1 medical support facilities.<sup>19</sup>

The author purposes creating a SOF Combat Medic (SOCM) as a new definition to be applied to NATO SOF medical professionals. A SOCM is a Soldier trained in advanced medical care directly assigned or attached to SOF and who provides direct health service support to Special Operations Task Units (SOTUs) on operations. SOCMs are trained to initially treat and sustain a casualty from point of injury for up to 36 hours before transfer of the casualty to MEDEVAC or non-standard medical treatment facility. SOCMs maintain the skill set trained to medical first responders, common core tasks for conventional medics, advanced tactical providers<sup>20</sup> (the DA/SR medical skill sets), preventive medicine, and environmental/tropical medicine. Initial training for SOCMs includes courses in basic human anatomy, basic human physiology, basic medical terminology, pharmacology calculations, and basic math. The SOCM course content should include, but is not limited to, basic trauma management, pre-hospital trauma management and care, advanced trauma life support, BLS, ALS, inpatient/post-operative nursing skills, minor and invasive surgical procedures.

The author also purposes creating a SOF medical provider (SFMP) as a new definition to be applied to NATO SOF medical professionals. SFMP was chosen to highlight the “independent provider” status of the advanced training for a SFMP. A SFMP is a SOF Soldier trained in advanced medical care, or a medical professional directly assigned or attached to SOF and who provides direct health service support to SOTUs on operations. SFMPs are trained to operate independently from the direct supervision of a physician. SFMPs are trained to initially treat and sustain a casualty from point of injury for up to 72 hours, and in some mission sets for even longer periods before transfer of the casualty to MEDEVAC or non-standard medical treatment facility. The SFMPs’ medical skill sets are based on the types of patients expected in a conventional forces environment, as well as those in hostile, denied, or politically sensitive areas. By nature, SOF operations are conducted across the full range of military operations, independently or in conjunction with conventional forces. Political-military considerations often shape SOF operations, requiring discreet, covert, or low visibility techniques that may include operations by, with, and through indigenous forces. SOF operations differ from conventional operations in degree of physical and political risk, operational techniques, modalities of employment, and in-

dependence from friendly support. These mission requirements are the nexus for the following list of subject areas and specific task that are core medical skills to be initially trained and sustainment training requirements for SFMPs. Initial training requirements for SFMPs include all of the training for SOCMs, with additional training in primary, preventive medicine, anesthesia, and advanced invasive procedures as described under “primary care or emergency care doctor.”<sup>21</sup>

NATO SOFs’ ability to triage, treat, transfer, and recovery of casualties is critical to sustainment and regeneration of the force. Role 2 SOSTs will provide the ability to mitigate death from non-compressible hemorrhage, the leading cause of death to SOF Soldiers who die of wounds.<sup>22</sup> The Role 2 SOST will be able to perform up to 10 DCSs without re-supply; manage two critical care patients for up to 48 hours; perform en route critical care for up to two patients at a time; and integrate seamlessly with SOF.<sup>23</sup>

SOF medical capabilities have been invaluable in establishing rapport with allied and coalition regular and irregular forces, assisting the local populace, and countering enemy propaganda about international motives and intentions. SOF TCCC, SOCMs, SFMPs, and Role 2 SOST capabilities enhance our ability to provide life saving treatment to combatants and non-combatants affecting the outcome of any casualty situation. In addition to saving the lives of SOF Soldiers, coalition partners, and non-combatants, it plays a vital role across NATO SOF missions. The care provided to indigenous people is one of our strongest weapons in the battle for “*hearts and minds*.” It brings a universal message of NATO as liberators rather than occupiers and gains popular support, willing cooperation, and intelligence.<sup>24</sup>

With an understanding of the current development in defining the capabilities for NATO SOF HSS, let’s review some identified areas that are resistant to change, or may impede the progress of NSTI within SOF HSS and FHP.

Currently, no centralized knowledge base on all alliance and coalition SOF medical capability exists. The author intends to develop this information for medical planning and is continuing dialogue with contributing nations to establish this information. Establishing working relationships with the ACO MEDAD, JFCs, ISAF, and national SOF medical staff will enable the NSCC to develop this working knowledge, and be able to advise and assist NATO SOF planners on current and future operations.

National strategic considerations have limited what information some countries are willing to share in

regard to their capabilities. The NSCC will continue to foster a climate of trust. Safeguarding national concerns is essential to information sharing within NATO.

Currently, no standardized definition exists for NATO SOF non-credentialed providers. Whereas NATO has policies for doctors and nurses, it has restrictive policies for non-credentialed providers. NATO conventional non-credentialed medical providers are based on conventional medical support systems within MTFs in direct support of or in proximity to a credentialed providers. The author is gathering national input and consensus on the proposed definitions for NATO SOF medical professionals. This work will be the foundation for development of initial and sustainment medical training requirements within NATO SOF. The lack of a certain level of SOF medical professional is not a sign of a nation's inability to support SOF, but rather a planning consideration in the force generation process.

European Union and national policies currently limit advanced medical training and sustainment training of non-credentialed providers who lack a recognized civilian equivalent medical provider. Many NATO contributing nations have patriarchal civilian medical systems, where the "doctor" is the primary decision maker and completes most invasive procedures; this is reflected in their concepts and policies relating to HSS. Medical reforms within NSTI will revolve around lessons learned and the realities of combat casualties' deaths that may ensue as the result of Cold War medical policies and doctrine based around robust host nation infrastructure and response. It is imperative that a system be developed to enable the NSCC to be a gathering point of best SOF medical practices based on lessons learned fed by input from SOF on current and recent operations.

Some contributing nations have limited or no permanent medical staff within their national SOF command structures that limits their ability to effectively influence timely change. There are also national medical structures that do not delegate authority of SOF medical training requirements and points of instruction to their national SOF commands. This can be

overcome by education of SOF specific medical requirements, best practices for joint level staffing/manning, SOF medical lessons learned, and best practices to positively influence international chiefs of medical departments, and mentor NATO SOF members who are limited by people, funding, technology, or training restrictions.

The author will be engaging NATO's conventional medical planners this spring at the NATO Medical Conference where he will highlight similarities and significant differences between NATO conventional and SOF HSS capabilities and identify current gaps in requirements. The intent will be to stimulate thought, generate dialogue, and make formal contact between the NSCC and national SOF command level medical staff. At the NATO Medical Conference in the fall of 2009, the author intends to engage NATO and Partners for Peace (PfP), SOF Surgeons, and medical planners in a NATO SOF Medical Working Group (WG) to refine and further develop NATO SOF medical doctrine and policy. The development of an ongoing NATO SOF Medical WG will be reviewed at that time.

This article gave a brief overview of the establishment and development of the NSCC, and reviewed the NSTI concept development. It proposed the establishment of new NATO SOF definitions to define SOF medical capability using the battle focused training model. Through an understanding of the definition of "SOF medical professionals," sharing medical intelligence resources, and identified best practices for medical support to SOF we can foster best practices within NATO SOF. The article discussed the development of NATO SOF medical doctrine and policy, and reviewed some barriers to change. Lastly, it set an agenda for change over this coming year to establish relationships between the NSCC and NATO Special Operations medical staff at strategic and operational levels. Please contact the author to provide input into the development of NATO SOF medical doctrine and policy. Your contributions are critical to this effort and are essential to corporate understanding, improved interoperability and to establish NATO SOF common "capability" or definitions.



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# Damage Control Resuscitation for the Special Forces Medic: Simplifying and Improving Prolonged Trauma Care: Part One

COL Gregory Risk MD; Michael R. Hetzler 18D

## ABSTRACT

Current operational theaters have developed to where medical evacuation and surgical assets are accessible in times comparable to the United States. While this has been an essential tool in achieving the best survivability on a battlefield in our history, the by-product of this experience is a recognized shortcoming in current protocols and capabilities of Special Forces medics for prolonged care. The purpose of this article is to provide a theory of care, identify training and support requirements, and to capitalize on current successful resuscitation theories in developing a more efficient and realistic capability under the worst conditions.

Our forces enjoy high confidence in rapid casualty evacuation and surgical intervention thanks to the proximity and availability of those assets in today's developed theaters. While prehospital care has evolved to an exceptionally high standard due to these capabilities, the ability of Special Forces (SF) medics to conduct independent and prolonged care has suffered because of them. Past experiences and future possibilities will require a return to prolonged, sustained care, as well as the development of new standards for all Special Operations Forces (SOF) medics based on the latest and proven theories. This capability can have significant application in today's missions ranging from Foreign Internal Defense in austere environments, a distant outstation isolated by weather, a Special Reconnaissance patrol inaccessible due to conditions in a mountain range, or even in short-term direct action missions when cut off from friendly forces and support. We can also take lessons from the recent Israeli invasion of southern Lebanon in 2006 when both conventional and Special Forces medics were forced into long term care. In this example of a modern low intensity conflict, even casualty evacuation over short distances was limited due to battlefield dynamics, troop disposition, and terrain.<sup>1</sup>

Critical care and resuscitation between point of injury and surgical intervention may be the missing element here, and should include the capacity for extended care, delayed hand-off, and late surgical suc-

cess. Prehospital care is relative to the situation. For most, it is only the treatment given at the point of injury immediately prior to hand-off to an evacuation platform. In Special Operations those lines are neither so clear nor so rapid; the scope and duration of care provided by SF medics may equate to that of a physician at more than one conventional level. Prehospital care for operations in austere environments includes: point of injury, evacuation concerns, resuscitation, prolonged care, as well as all the skills required of those (Figure 1). Sustaining a patient in an operational environment for days post-event is no easy task. And while maintenance of a casualty for 72 hours post-op is required training at the Special Warfare Center, the focus here is the implementation of current and proven strategies to maximize the patient's chances of survival.

Compared Stages of Care	
<u>Conventional Forces</u>	<u>Special Forces</u>
Point of Injury	Point of Injury
Evacuation	Resuscitation & Prolonged Care
Field Surgical Team	Evacuation
Evacuation	Surgical Intervention
Definitive Care	Definitive Care

**Figure 1:** The stages of care differ remarkably not only due to the assets involved, but by the scope of care required from SF medics and Independent Duty Corpsmen when compared to conventional systems.

This article is the first of two meant to provide an approach to critical care using damage control resuscitation (DCR) as a guideline adapted for our use. DCR is a current and proven practice and provides aggressive and effective trauma management with minimal support while preparing the patient for the next level of care. DCR consists of two parts: first, keeping blood pressure at approximately 90mmHg, and second, to rapidly reverse coagulopathy and restore oxygen carrying capacity with fresh frozen plasma (FFP) and packed red blood cells (PRBC).<sup>2</sup> Since FFP and PRBCs are unavailable far forward, we are advocating the earlier and more aggressive use of type-specific fresh whole blood (FWB) as the only workable solution for salvaging patients with life-threatening injuries. Fresh whole blood delivers normal physiological ratios of essential elements, with more active clotting factors than banked component blood, and at normothermic temperatures.<sup>3</sup> Indications for FWB use is based on patient presentation and lab results such as lactate, base deficit, pH, and hematocrit which will also later serve as endpoints in resuscitation, ensuring efficient therapeutic objectives. While “balanced” or “hypotensive” resuscitation works well in the short term, a patient left hypotensive and under-resuscitated for a prolonged period cannot be sustained. Trauma patients who do not normalize their pH or base deficit have significantly higher mortality at 24 hours and near universal mortality at 48 hours.<sup>4</sup>

Patient care in the austere environment is incomparable to that in a U.S. hospital. With that in mind, the scope of practice, therapeutic guidelines, procedures used, benefit vs. risk analysis, and clinical tenets, significantly differ from a civilian emergency room or even that of a combat surgical hospital (CSH). Many may question the standards of care recommended, but they probably do not appreciate the challenges SF medics face. Prolonged care in the primitive setting cannot support current hospital-based parameters, and a return to unconventional warfare practices is warranted and necessary. Strict clinical practices are respected and exercised, but not always attainable in our environment. Careful review of many long forgotten practices from previous conflicts may yield surprising results. The use of tourniquets, damage control surgery, and plasma and whole blood transfusions, are all being resurrected with improved patient outcomes in the 21st century. Many believe the most difficult challenges are found in the austere environment, and this may be where DCR is of most benefit.

The following recommendations to SF medic’s were gathered from a number of physicians and institutions that have compiled an impressive bank of credible

and groundbreaking theories over the last seven years. Our effort here is to capitalize on those lifesaving protocols, merge the conventional levels of care with our overlapping SOF capabilities, and apply them in our rigorous environment.

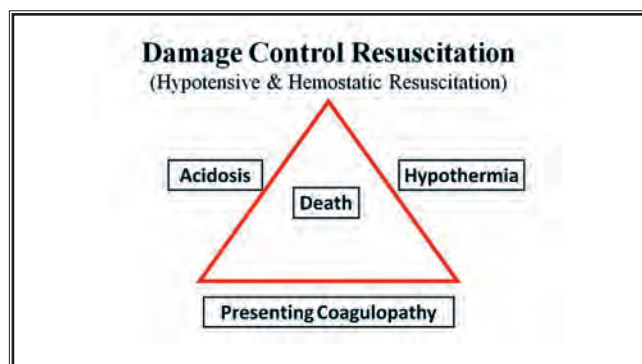
## OVERVIEW

The Tactical Combat Casualty Care Committee (TCCC) has continually updated guidelines since 1996 for prehospital care on the battlefield as defined in three levels: Care Under Fire, Tactical Field Care, and Tactical Evacuation Care. These guidelines are based on medic, corpsman, and physician input and experiences through quarterly conferences. However, TCCC guidelines only provide the basis for care at the point of injury through evacuation. This article maintains those guidelines, but will leave initial management behind as SF medics move on to 12 to 96 hours post event.

Damage control surgery (DCS) is a well established and proven modality of medical intervention in both civilian and military practice.<sup>5</sup> The U.S. Army Institute of Surgical Research (ISR) has provided the most up-to-date collection, evaluation, and development of critical care for war wounded, and additionally has driven implementation of this theory within all the services. Damage control focuses on principles that allow for highly efficient care while compensating for inexperience and limited resources as the “great equalizer” of trauma surgery.<sup>6</sup> Using the damage control model for a ship, the goal is to rapidly implement measures that prevent further deterioration before irreversible injury occurs, or “the ship sinks.” Most initial treatments are temporary to minimize patient exposure to stressful surgical conditions and to reduce a physiological loss which maximizes the patient’s preparation for more extensive care. Definitive surgical repair of injuries prior to adequate resuscitation may lead to a fully repaired but unsalvageable patient. The primary and most immediate goal is surgical control of hemorrhage with judicious fluid resuscitation, which is accomplished with a number of advanced surgical procedures such as rapid closure, shunting, or packing. Stopping further contamination through exploration and additional therapeutic serves as a concurrent effort and significantly decreases septic effects that can impact mortality over time. The patient then moves to the intensive care unit to receive resuscitative care preparing him for return to the operating room within 24 to 48 hours for definitive surgical repair. Understanding this entire process is paramount to “*act* tactically, but *think* strategically”<sup>7</sup> in preparing patients for a successful outcome. This treatment strategy must be understood to prepare the patient



at this level; the SOF medics primary goal is to ensure that the patients arrive at surgical assets properly resuscitated.



**Figure 2:** The lethal triad easily visualized, attributed to Colonel John Holcomb.

Damage control resuscitation guidelines are specifically focused on the prevention of the “lethal triad” consisting of hypothermia, coagulopathy, and acidosis; all of which can be either mutually supporting or mutually destructive (see Figure 2). The factors of the lethal triad are all proven independent and codependent indicators of mortality which also apply to DCS. Damage control resuscitation guidelines also include aggressive hypotensive and hemostatic resuscitation while providing parameters for addressing all three areas of the lethal triad. Ensuring that these efforts are proactive and continuous from the point of injury provides the most efficient care possible and uses a more scientific and therapeutic approach to combat trauma for SOF medics. Again, the medics care can and should potentiate success in supporting both TCCC and DCS in the hospital.



**Figure 3:** An OSS doctor conducts minor surgery in China circa 1944. (Courtesy USASOC Historian's Office)

## IMPORTANCE OF HEMOSTASIS

The single most essential weapon for DCR is immediate and effective hemostasis, and it is at the point of injury where resuscitation *begins* for the SOF medic. Hemorrhage control is the conservation of every single drop of blood and with it every key ingredient that provides success against the lethal triad. The loss of blood leads to hypoperfusion of tissues, relative hypoxia, and promotes anaerobic metabolism. This subsequently promotes acidosis, hypothermia, and loses key coagulation factors that are not easily reclaimed. Minimizing blood loss by immediate and effective treatments is a fundamental trauma skill. Perfecting the basics will gain hemorrhage control in the least amount of time and with minimal supplies while increasing survivability with DCR.

The physiologic picture resulting from hemorrhage easily demonstrates the interacting and accumulating factors that will be important later. Blood loss not only includes red blood cells essential for tissue oxygenation but also critical coagulation components such as platelets, clotting factors, and enzymes. Currently these factors can only be replenished in the most difficult procedures for the SF medic, especially when time, enemy situation, and supplies may all be at odds. A loss of blood volume reduces total oxygen carrying capability, which is compensated by increases in both inotropic (contractility) and chronotropic (heart rate) effort until the mismatch in oxygen delivery and demand result in tissue hypoxia, or true shock. At this point, the affected tissues convert from aerobic to anaerobic metabolism, which exacerbates all three components of the lethal triad. Cellular hypoxia results in a 90% reduction in energy production and an increased rate of lactate production promoting metabolic acidosis. This action leads to cellular swelling and edema, which further diminishes capillary flow and microcirculation irrespective of mean arterial pressure (MAP). Additional hypoperfusion due to vasoconstriction occurs naturally and simultaneously by lowered blood pressure, pain, and cortical recognition of injury. A lack of blood supply to the liver results in decreased glucose and clotting factors further complicating coagulopathies. Other physiological damage occurs when pro-inflammatory mediators are released due to hemorrhage and tissue damage, and shock affects neuroendocrine responses producing severe metabolic changes.<sup>8</sup>

Direct pressure is always the first step for hemostasis. As soon as hemorrhage is noted, dig-



**Figure 4 :** A Special Forces medic conducts an I & D procedure in Bolivia in 1967.  
(Courtesy USASOC Historian's Office)

ital or manual pressure is paramount and almost always assures immediate effectiveness. Remember, the goal is not just to limit the amount of blood loss, but to save every single drop possible. Paramount towards this end is the expectation that each Soldier, if able, performs self-care. This requires mental preparation, muscle memory, and psychological hardening to perform under physical pain, stress, and challenging conditions. Pressure points are next, or act as an adjunct to minimize blood loss and always attempt to use other Soldiers to deal with pressure points even under the best circumstances. The benefit is reduced time to hemostasis and preserved blood volume, while maintaining combat power during the fight. Other essential multipliers include the medic placing pressure with his own knee while he works, or effective support from his teammates from prior cross-training or on-scene instruction. Tourniquets are extremely effective in the treatment of extremity wounds and their success since 9/11 is inarguable. There have been no reports of amputations during the conflict directly attributable to tourniquet usage. Remember that bleeding control is a graded response, so if a limb is mangled enough a tourniquet will likely be the first step in hemorrhage control.<sup>9</sup> Tourniquet effectiveness is based on the principles of ensuring they are placed proximal to the wound, active bleeding stops, the distal pulse is absent, and that reassessment is frequent and continuous. Keep in mind that the duration a tourniquet is applied will bring new concerns in prolonged care. Present standards call for removal within

two hours and, if conscious, the patient will remind the medic of this with the pain that normally accompanies prolonged tourniquet use. Application over two hours can also predispose the patient to increased morbidity such as fasciotomies and amputations, all of which may later be the medic's responsibility in this scenario.<sup>10</sup> Converting a tourniquet to an effective pressure dressing as soon as possible while leaving the tourniquet loose and in place, for use if reapplication is necessary, will likely prevent issues later in prolonged care.

Packing wounds is a science in itself, requiring effective technique, proper supplies, and completed with a pressure dressing to optimize the medic's work. Making the decision to pack early is important too; packing is dependent on the patient's ability to form good clots and if too many factors are lost, then packing will not be effective. Bowl-type wounds must be addressed immediately by packing with a maximum of two fingers using unrolled Kerlix® and working from the bottom of the wound up, left to right or circumferentially, as if filling a bucket. Finding and addressing all potential space in the wound to ensure that there is no opportunity for any leakage of blood is a difficult task, especially while packing blindly, in the dark, and under stress at speed. An effective packing job can provide hemostasis with a minimum amount of supplies. Packing should not only be reserved for bowl-type wounds but also used in anatomical girdle areas such as the groin or shoulder. Hemostatic agents provide additional tools for more difficult wounds but they require thorough training, ideally during predeployment trauma training, to utilize effectively. The same rule applies for hemostatics as with packing: hemostatics + packing + pressure = success. Future technologies that are presently being developed for advanced hemostatics such as vessel closure and pressurized viscotoc hemostatics may offer additional adjuncts in time.

#### PREVENTION OF HYPOTHERMIA

Within the lethal triad itself, the prevention of hypothermia is probably the simplest and most practiced effort for SOF medics. Hypothermia has significant effects and yields 100% mortality to severely traumatized patients with core temperatures less than 90°F (32°C).<sup>11</sup> The goal is to maintain the casualty's core temperature to greater than 95°F (35°C). Preventing hypothermia takes far less effort and time than attempting to treat it under combat conditions.

Temperature monitoring should be as continuous as possible. Use every tool in sequence from skin color and extremity warmth, patient feedback, and mentation. Objective findings can be obtained from tools

such as inexpensive temperature dots placed on the forehead or intermittent temperatures taken with an oto-thermometer, or use a digital rectal thermometer for continuous and high confidence readings. The fact that most wounded patients very often feel cold post-insult or the observance of spontaneous shivering, should always key the medic in to the above steps. In short, simply treat every single patient relentlessly for hypothermia.

Hypothermia prevention should start immediately post-injury. Consideration of heat loss goes hand-in-hand with the initial assessment and optimally should occur during the primary survey or just immediately thereafter. Most of this work can be accomplished by cross-trained teammates automatically and simultaneously as the medic treats. Plan, prepare, and practice hypothermia prevention during all aspects of training; immediately insulating patient contact with the ground, minimizing exposure during the primary exam, removing only wet clothing, and even keeping the patient clean are all essential principles decreasing heat loss. Use every opportunity to get the patient off the ground, dried if possible, covered, and out of the elements and begin all proactive efforts for economy of time.

Both passive and active measures should be planned for. Standard commercial hypothermia kits should include a durable and effective solar blanket and a chemical warming blanket, and these should be kept with litter kits. Open the warming blankets first as they normally take some time to reach its full exothermic reaction. The solar blankets are normally vacuum sealed so it should be stretched to full size to open any incorporated air cells. Position it diagonally on the litter so that the head and feet lie on the longest ends of the blanket and move the casualty to the blanket as quickly as possible to get him off the ground and negate conduction. The patient should then be “burrito” wrapped with the blanket as tightly as possible; it is the air closest to the patient, or within the air cells of the blanket, that provides the insulation for heat retention. Trapped air between the patient and the blanket is warmed by the body and then retained and protected from loss or change by the blanket. If standard hypothermia kits are not available, wool or space blankets wrapped in the same manner and with some kind of head insulation (up to 60% heat loss here) such as a wool skull cap will provide much of the same effects.

Active warming measures require prior planning and usually cannot be achieved through improvisation. The chemical warming blanket opened first should be laid between the patient and the solar blanket to provide some degree of active heat on all patients. Be

aware that there are differences in products and manufacturers so always rehearse this procedure. There are many different types of commercial kits and each has varying temperatures, durations, and effectiveness. Warming all fluids before giving should be the goal no matter what type, route, or environment. IV warmers such as the enFlow® warming system or the Thermal Angel® have proven effective, but both have specifics that need to be appreciated in the tactical environment. A significant amount of heat can be lost through the administration line. Using a closed-system kept next to the patient with minor infusion pressure, or protecting the administration line with insulation and minimizing its exposure to the elements, is important. Although the lack of a fluid warmer does not preclude establishing IV/IO access or administering appropriate fluids, withholding warm fluids is of detriment to the patient.

Primitive warming in an austere environment can be simple and is limited only by the medic’s imagination. Using vegetation to insulate patients from the ground, finding civilian blankets from a house, simple shielding or overhead cover from the elements, heat bottles and active heat sources, and proper nutrition would all be beneficial. Primitive means to warming fluids such as using MRE heaters packaged in plastic bags are effective as well, but must be rehearsed and learned. Body bags, although not without possible psychological effect, are extremely effective in heat retention and protection and have been used in great success in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF).

Expedited evacuation has become the norm in OIF, but exists as a double edged sword. Timely evacuation mitigates the environmental effects of prolonged



**Figure 5:** A Detachment 101 surgeon works on wounded in an austere environment during World War II. (Courtesy USASOC Historian's Office)



exposure. Conversely, the customary rapid rotary wing evacuation may contribute significantly to converting a patient from normothermic to profoundly hypothermic; remember not to negate the benefits of a speedy transportation with an ill-protected patient. Timely air evacuation by itself is not the solution as a 2004 study from OIF found that 91% of all casualties that arrived to the CSH by air were hypothermic as exposure and convection from wind flow took its toll.<sup>12</sup> Optimization of these critically ill patients during transport is an important strategy to increase survival on the battlefield, replacing hope with capability.<sup>13</sup>

Hypothermia exacerbates coagulopathies primarily by negating the full potential of the clotting process itself due to a loss of homeostasis. If the body functions optimally at 98.7°F then anything less decreases its physiological response to a severe insult, thereby compounding the issues overall. Coagulation function in total is decreased by 10% with every degree point between 34°C and 32°C itself, and also independently affects specific clotting factors at different levels. Mortality is also significantly increased; a trauma patient with a core temperature below 90°F (32°C) is associated with near 100% mortality.<sup>14-16</sup> Hypothermia additionally delays the onset of thrombin generation, thrombin function, and additional cofactors required in the clotting cascade. Concurrently, platelet adhesion, interaction, and aggregation are debilitated outside of normal temperatures and all of the enzymes required in the clotting cascade are also suppressed.

## MANAGING ACIDOSIS

The prevention of acidosis is the final component of the lethal triad which must be considered in managing patients for prolonged periods. Acidosis develops primarily due to cells being forced into anaerobic pathways for energy, and the degree of acidosis in the blood markedly underestimates the degree of intracellular acidosis. As cells die, they release an increasing amount of lactic acid into the system. As such, marked decreases in systemic pH may be a premorbid event, and mark irreversible uncompensated shock. Even more challenging is the fact that if perfusion is restored to previously hypoxic cells, accumulated acids will be released into the systemic circulation leading to a reperfusion syndrome. Therefore, combat casualties with any degree of hemorrhage should be considered at risk for developing acidosis, especially when the short-term care and rapid evacuation become a long-term resuscitation challenge due to a changing battlefield. The ability to maintain adequate breathing and ventilation,

achieving the appropriate goals for endpoints, and again rapid evacuation, mutually supports all other efforts.

Small changes in pH have more profound effects on coagulation than even small changes in core temperature. The coagulation proteases necessary for the activation of both the intrinsic and extrinsic pathways are optimized to function in the alkaline range. A decrease in pH from 7.4 to 7.0 reduces the activity of the enzyme complex that activates thrombin by 70%.<sup>17</sup> The previous point leads to the possibility that active correction of pH and administration of thrombin may be areas of future research in hemorrhagic trauma.

Hypothermia and acidosis provides a clear example of how the three factors in the lethal triad are interrelated: Acute hemorrhage leads to hypotension with decreased systolic blood pressures, which in turn leads to reduced oxygen perfusion to tissue. Decreased O<sub>2</sub> delivery results in a change in energy consumption from aerobic to anaerobic metabolism, which then produces lactic acid as a byproduct, which contributes to overall acidosis. Anaerobic metabolism itself is inefficient and decreases normal energy production and heat generation which then negates the body's ability to recover from temperature loss. The resulting acidosis interferes with the clotting cascade, and leads to further hemorrhage during resuscitation, leading to death if not prevented or aggressively interrupted.

## CORRECTING COAGULAPATHIES

Addressing presenting coagulopathies is the primary focus of DCR seconding acidosis and hypothermia in priority. As mentioned before, minimizing blood loss from the very onset with hemorrhage control keeps RBCs and clotting factors onboard, and assists in maintaining a natural acid base balance for as long as possible. Hemostatic dressings and vascular access provide additional lifesaving capabilities with increasingly effective products on the market, and advanced techniques developed to address non-compressible hemorrhages. The early use of recombinant Factor rVIIa in severe blood loss and coagulopathy can be another choice as a treatment adjunct. Rapid evacuation to the next level of care again provides access to surgical interventions and blood banking to interrupt the progress of the shock. If rapid transport is unavailable, we must consider other approaches to maintaining the casualty, and interventions of a more creative nature.

Additionally, it appears that a subset of trauma patients present coagulopathic, not secondarily as a result of blood loss, acidosis, and hypothermia, but as a **primary** response to the traumatic insult.<sup>18</sup> This group

of patients become coagulopathic much earlier for reasons that are at present not well delineated. That fact, coupled with the hemorrhage due to penetrating trauma may lead to a disproportionate loss of clotting factors, inactivation of normal coagulation due to acidosis and hypothermia, and inactivity of factors due to storage in banked blood and blood components. Consequently, in non-compressible hemorrhage on the battlefield, in an otherwise young and healthy population, there may be a role for early augmentation of the coagulation cascade. As previously noted, the proteolytic enzymes of the coagulation cascade function poorly at pH below 7.2. Acidosis slows the rate of thrombin generation, while hypothermia delays the onset of thrombin generation. Biologically plausible arguments can be made for optimizing and augmenting the coagulation pathways and processes *before* significant hemorrhage occurs and shock develops as will be discussed.

While we have for the most part solved the challenge of extremity injury with the use of tourniquets, pressure, and wound packing, the developments of new types of hemostatic agents in the form of a pad, packing sponge, or gel have provided adjuncts for compressible and accessible wounds. The current challenge in the field for the medic is the non-compressible and non-accessible wounds, primarily in the abdomen and pelvis in the absence of immediate surgical assets. Because of this, the use of non-surgical solutions needs to be aggressively considered. This would include the use of Factor VIIa, along with adjuncts such as calcium and sodium bicarbonate to optimize the biological activity of this potentially lifesaving modality. Factor VIIa works by activating through thrombin and various feedback loops both the intrinsic and extrinsic coagulation pathways. The desired endpoint is assistance in the formation of a thrombus at the site of injury in an otherwise inaccessible location such as solid organs (liver, spleen, and kidney), large vessels, and pelvic structures. This might be thought of as mobilizing a damage control party to the site of injury in our ship analogy. Because of the time involved, this must be considered for administration relatively early if severe hemorrhage is suspected. Delays awaiting conclusive evidence of Class III/IV shock may prove insurmountable. Interestingly, there is some evidence that thrombus created with rVIIa ad-

ministration may be more resistant to lysis and breakdown with reperfusion.

Correcting coagulopathies will also be assisted by administering the proper blood products, and although FWB and FFP are specifically advocated in this article due to their natural contributions, they will be addressed in Part Two, complete with all other fluid choices. In addition to resuscitation, prolonged care requires an exceptional skill set. Tracheotomies, fasciotomies, blood transfusions, anesthesia, and primary and delayed closure, all play an important role here. These are advanced skills and as such require proper sustainment. Nursing skills also have a huge importance in critical care and without them none of the above would be successful. Competence in aseptic technique, antibiotic therapy, labs for the monitoring of endpoints, input and output, and basic nursing care including patient hygiene need to be appreciated. Other concerns requiring attention are pre and post surgical skills, wound care, nutrition, rehabilitation, and even logistical needs. This skill set is now rarely exercised, except in the schoolhouse during records and reports, but is essential in the austere scenario.

The authors hope that Part One provides a foundation in general knowledge of DCR for the SF medic; Part Two will identify options for measuring shock and recommend relative endpoints to serve as goals in resuscitation. Additionally we will propose not only the special equipment required, but the minimal equipment needed in care, and identify the critical care and nursing skills required to support DCR in our environment.

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# A Review of the Use of Early Hypothermia in the Treatment of Traumatic Brain Injuries

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## ABSTRACT

Traumatic brain injury (TBI) is an assault to the brain that disrupts neurological activity. Known as the signature wound of combat during Operations Iraqi Freedom (OIF) and Enduring Freedom (OEF), it has become one of the most common injuries to American Soldiers. While affected Soldiers may remain stable after the primary injury, progressing secondary mechanisms can produce neurological degeneration. Hypothermic medicine is the treatment of injuries by cooling the core body temperature below normal physiological levels. Such treatment may be indicated to improve neurological outcomes after traumatic brain injuries by reducing the evolving secondary deterioration.

To date, clinical trials have reached mixed conclusions. Trials have used unique temperature goals for treatment, different methods and times to reach such goals, and different durations at therapeutic temperature. Such variances in procedure and experimental populations have made it difficult to assess significance.

In the article written by Markgraf et al. in 2001, research in animals showed the effect of hypothermic treatment within rats. Their results suggest that early initiation of hypothermic medicine after an induced traumatic brain injury (TBI) improved neurological outcomes when the body was cooled to 30°C within four hours. An ongoing study by Clifton et al., on adults diagnosed with TBI, is examining the neurological outcome of early hypothermic medicine by centrally cooling the body to 33°C and maintaining that temperature for 48 hours.

While previous hypothermic devices were unable to cool rapidly, new technology allows achievement of the goal temperature within 20 minutes. Implementation of such new treatment may show an improvement in neurological outcomes for patients when treatment target temperature is reached within a four-hour window. We recommend that the use of hypothermic medicine should be re-evaluated for its indication in TBI due to the capabilities of a new extremely rapid cooling device.

## INTRODUCTION

Traumatic brain injury (TBI) is an insult to the brain that disrupts neurological activity and has become one of the most common injuries to American Soldiers subjected to explosions from improvised explosive devices (IEDs), vehicle borne IEDs (VBIEDs), and suicide bombers. One report indicated that by January 2008, over 5,500 Soldiers had suffered such injury during the Iraq and Afghanistan conflicts.<sup>1</sup> In 2008, about 33% of Soldiers requiring medical evaluation for battle-related injuries who were transported from areas of armed conflict to Walter Reed Army Medical Center (WRAMC) had TBI.<sup>2,3</sup>

Traumatic brain injury occurs most commonly due to proximity to blast explosions as expanding air pressures apply extreme forces to the head, but it can occur with other types of head trauma, such as penetrating wounds, violent physical blows, and from impact with any propelled solid object including shrapnel from explosions or explosively formed penetrators

(EFPs). A TBI can also result from rapid accelerations-decelerations of the head due to blast waves even in the absence of an impact from a solid object.<sup>3,4,5</sup>

Mild TBI includes any trauma to the head that may result in loss of consciousness or alterations in mental status. However, the definition of mild TBI is difficult to establish and may only present as headache, dizziness, lack of concentration, or memory loss. Severe TBI is an insult that leaves patients in a persistent coma following medical and surgical therapy.<sup>6</sup>

Multiple factors can initially result in damage at the time of the assault: Nerve fibers can shear in which neurons are stretched and torn, the brain tissue can bruise, and vessels can be compromised producing ischemia or forming destructive pressures.

In addition to the initial disruptions, secondary injuries from multiple elements can lead to new or further neurological deterioration. Increased intracranial pressures (ICPs) are typically at the highest within the

first three days of injury, although one-quarter of TBI patients reached maximal ICPs after day five.<sup>7</sup> Other delayed injuries can be due to factors released during injury that in time induce inflammation, production of free radicals, release of the excitatory neurotransmitter glutamate, electrolyte disturbances of the neuron, and mitochondrial dysfunction.<sup>6</sup> Even though affected Soldiers can be stable and functional after the TBI, these secondary factors can lead to severe neurological deterioration within three to five days post-injury. In standard healthcare, the concentration of care for TBI patients goes into reducing these secondary effects. It would be optimal to prevent secondary injuries in order to prevent secondary neurological damage.

Hypothermic medicine, which is the treatment of injuries by cooling the core body temperature below normal physiological levels, was studied in use of brain injuries for over 50 years. Mild hypothermia has been studied extensively in animal models and is defined in humans as the achievement of core body temperatures of 33-34°C. Such treatment may be indicated to improve neurological outcomes after TBI by reducing the evolving secondary injuries through multiple means. One of these was the decrease of cerebral edema and brain swelling.<sup>8</sup> In an animal-model experiment by Markgraf in 2001, early administration of hypothermic treatment within four hours was shown to reduce maximal ICPs at 24 and 48 hours after TBI.<sup>9</sup>

Mild hypothermia may also inhibit the buildup of the neurotransmitter glutamate<sup>10,11</sup> and reduce the metabolic rate of neurons.<sup>8, 12</sup>

Hypothermic medicine may attenuate neuronal death by turning off several chemical pathways of cellular apoptosis.<sup>13,14</sup> Such treatment may also inhibit the inflammatory response by preserving the blood brain barrier<sup>15</sup> or reducing pro-inflammatory cytokines.<sup>16</sup>

After trauma the reperfusion of brain tissue forms free oxygen radicals that damage the cellular membrane of neurons leading to cell death. Hypothermic treatment increases the function of superoxide dismutase, an enzyme that limits the damage of free oxygen radicals and protects the cellular membrane.

Ultimately, hypothermic medicine may assist in the reduction of secondary insults to neurological tissue, perhaps not through all means discovered in the laboratory, but probably through more than one factor described.

## ADVERSE EFFECTS

Treatment with hypothermic medicine carries the adverse risks of cardiac arrhythmia and thrombocytopenia. However, arrhythmia risk is typically only increased during moderate hypothermia, when the body is cooled below 30°C. Since most controlled treatments remain above these temperatures, it is rare to find arrhythmias in hypothermic studies.<sup>17</sup>

Even though it is a common notion that lower body temperatures increase hemorrhage due to impaired function of platelets and coagulation proteins,<sup>18</sup> surgical patients undergoing controlled hypothermia at levels between 32.5 and 33.5°C for cerebral aneurysm clipping showed no greater significant blood loss.<sup>19</sup>

## EQUIPMENT

Various methods exist with which to administer mild hypothermia; however, to date only surface cooling and intranasal cooling systems have been tested in humans following TBI.<sup>17</sup>

The simplest method of inducing mild hypothermia for treatment is surface cooling. In the past, techniques included applied ice packs and submerging the patient in ice baths to drop core body temperature. The water-circulating surface cooling device consists of blankets placed directly on the patient with regulated cold water circulating through the blankets. The degree of cooling treatment water is determined by feedback from a rectal thermometer. Gel-coated surface cooling devices also exist that work on the same principles as the water-circulating blankets. Only here instead of blankets, transfer pads coated with adhesive gel are attached to the body along the back, abdomen, and bilateral thighs. More recently, helmets and caps have been designed to produce cooling in a more localized area.

Invasive methods such as intravenous cooling consist of a central venous catheter placed within the inferior vena cava. Cooled saline is pushed through the catheter balloons, which are in adjacent contact with the patient's blood. In this procedure the core body temperature is gauged by rectal means. This measured temperature induces a feedback loop that regulates the temperature of the therapeutic saline entering the body. This allows control over therapeutic measures. Another invasive method includes rapid infusion of lactated Ringer's at 4°C combined with surface cooling using ice packs. However, both these invasive methods compromise vasculature access and increase risk of infection and hemorrhage.

In a study by Hoedemaekers et al., it was shown that surface methods of water-circulating blankets and gel pads along with cooled at a rate of 1.33°C/hr, and 1.04°C/hr, respectively. Intravenous cooling with central catheter placement cooled at 1.46°C/hr. These three methods were far more effective than the conventional treatment of running cold lactated ringers solution (0.32°C/hr) and air-circulating cooling systems (0.18°C/hr).<sup>20</sup>

A new ice water immersion system propels and circulates a thin film of ice-cooled water directly around the patient's body in a special molded enclosed environment to reduce core body temperatures at a rate of 4.7°C to 6.6°C/hr. Patients may reach target hypothermic conditions within 20 minutes, at which time the de-

vice can be removed and the core body temperature will remain at a constant lowered value for hours.<sup>21</sup> This portable cooling system is presently the fastest cooling available and is comparable to controlled ice water immersion. (see Figure 1)



**Figure 1:** ICE Immersion

## TRIALS

To date, clinical results have been conflicting; many reports have been unable to reach proper efficacy in human trials due to a lack of comparable data between control and treatment groups. In association with this, different trials have used unique temperature goals for treatment, different methods and times to reach such goals, and different durations at therapeutic temperature.<sup>22</sup>

In 2001 a clinical trial by Clifton et al. presented no significant neurological outcome difference in severe brain injury patients who were treated with mild hypothermia compared to a normothermic control group. In this study the experimental group reached the therapeutic temperature goal of 33°C in the mean time of 8.4 ± 3.0 hours.<sup>23</sup>

Results of Markgraf et al. (2001) study suggests that early initiation of hypothermic medicine within one hour of an induced traumatic brain injury with rats, improved neurological outcomes when the body was cooled to 30°C. The therapeutic device utilized in this study achieved hypothermic target temperatures within three hours. Overall this meant that target core body temperatures were reached in less than four hours. When initiation occurred after 90 minutes, there was no observed change in neurological outcome.<sup>9</sup>

An ongoing study by Clifton et al. is examining the impact on neurological outcome of using hypothermic medicine to centrally cool the body to 33°C within four hours of traumatic brain injury and then maintaining that temperature for 48 hours.<sup>24</sup>

## CONCLUSION

TBI is considered by many to be the “signature wound” of the present conflicts in Iraq and Afghanistan, thus, further understanding of the mechanisms of injury and the treatment for such is imperative to military medical personnel.

While Soldiers may remain stable after the primary injury, progressing secondary mechanisms can produce neurological degeneration. Results of preliminary studies with hypothermic medicine suggest that this treatment may reduce some of the secondary mechanisms of TBI and also be an effective treatment through other means.

To date the clinical trials of therapeutic hypothermia have given mixed results. Results in animal studies of Markgraf et al. (2001) indicate that early induction of mild hypothermia could produce neuroprotective abilities, when target core body temperatures are reached within four hours after an induced neurological assault. If continued, a National Institute of Health clinical trial by Clifton et al. may be modified to achieve therapeutic temperatures of 33°C with the new fastest cooling portable system clinically available. While previously impossible to obtain such timely new treatment, advances in technology give new opportunities to answer the questions we have posed concerning prevention of secondary injury, and if the data is supportive of this concept, an opportunity to implement a field-ready system that has the potential for forward deployment.

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# Emergency Lateral Canthotomy and Cantholysis: A Simple Procedure to Preserve Vision from Sight Threatening Orbital Hemorrhage

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## ABSTRACT

Retrobulbar hemorrhage is an uncommon, but potentially devastating complication associated with facial trauma. It can rapidly fill the orbit and cause an "orbital compartment syndrome" that subsequently cuts off perfusion to vital ocular structures, leading to permanent visual loss. Treatment must be initiated within a limited time in order to prevent these effects; however, specialty consultation is not always available in remote field environments. This article addresses the mechanism, diagnosis, and treatment of retrobulbar hemorrhage via lateral canthotomy and cantholysis, and recommends that 18D medical sergeants be properly trained to evaluate and perform this sight-saving procedure in emergent settings where upper echelons of care are not immediately available.

## INTRODUCTION

Retrobulbar hemorrhage is a vision-threatening emergency often necessitating immediate lateral canthotomy for preservation of vision.<sup>1</sup> Prompt recognition and appropriate treatment of this ocular emergency is imperative, for timely management determines the ultimate outcome.<sup>2</sup> The medical literature describes multiple causes for true spontaneous orbital hemorrhage; however, head and facial trauma, as well as post-surgical complications, constitute the majority of emergent cases.<sup>3-14</sup> Reports of injuries in Operation Iraqi Freedom document the risk of orbital hemorrhage and subsequent orbital compartment syndrome (OCS) from penetrating trauma and the potential vision-threatening consequences.<sup>15</sup>

Retrospective studies show an incidence of co-existing retrobulbar hemorrhage in patients with orbital fractures of only 0.45-0.6%.<sup>16</sup> However, in patients experiencing acute vision loss in the setting of traumatic retrobulbar hemorrhage, the potential for permanent blindness is high (44-52%).<sup>17,18</sup> Although rare, the potential ophthalmic concern in a war-time environment becomes increasingly real, due to the higher incidence of facial trauma and delayed presentation to upper echelons where definitive ophthalmic care can be undertaken.

We agree with earlier assessments that the skills to recognize and treat vision-threatening orbital compartment syndrome (OCS) due to retrobulbar hemorrhage should be within the scope of a Special Operations Forces (SOF) medic and concur with the recommendation of Burns and DeLellis that the procedures of lateral canthotomy and cantholysis could and should be introduced into the SOF medical training curriculum.<sup>19</sup>

## MECHANISM

Retrobulbar hemorrhage causes a mass effect within the confined space of the orbit, and as it expands it impinges on sensitive ocular tissues reducing perfusion of the optic nerve.<sup>20</sup> The compartment is restricted in its ability to expand due to the bony walls. Anterior expansion does occur, causing subsequent proptosis, but it is ultimately limited by the orbital septum and the fact that the globe is tethered to the optic nerve.<sup>16,21-24</sup> An OCS ultimately develops, increasing orbital pressure, damaging the optic nerve by direct compression, and causing ocular ischemia via decreased perfusion from compromised vascular flow, not unlike that seen in other compartment syndromes.<sup>25</sup> If the patient is unconscious or uncooperative and has periorbital trauma,

the only sign of OCS may be elevated intraocular pressure (IOP).<sup>26</sup> Without proper perfusion, sensitive structures such as the optic nerve and retina have a limited time for survival and recovery. Review of the literature suggests that the window for visual recovery from the onset of decreased visual acuity to decompression is perhaps limited to approximately 120 minutes.<sup>10,27</sup> Two case reports document a four hour delay with improvement in vision to baseline, but these appear to be rare exceptions.<sup>28</sup> Hayreh's studies on Rhesus monkeys demonstrated central retinal artery occlusion of 105 minutes or longer produced irreversible optic nerve damage, and total optic nerve atrophy occurred with occlusion times that were greater than 240 minutes.<sup>16,29</sup> It is therefore of the utmost importance to recognize and treat retrobulbar hemorrhage with prompt decompression early in this 120 minute window if the devastating effects on vision are to be reversed.

Referral for immediate specialist assessment, if available, should not be delayed even in doubtful cases.<sup>24</sup> Similarly, primary examiners should not waste precious minutes with unnecessary investigations that delay treatment in the event specialist care is not present.<sup>24,28,30</sup> Ideally an ophthalmologist would be expected to perform this emergency orbital decompression. However, if an emergency ophthalmology consult is unavailable, any emergency responder trained to do the procedure should act immediately.<sup>26</sup> According to U.S. Navy family physician Dr. Mark Benton, "Knowledge of this procedure is a must for physicians, especially those in remote areas where access to ophthalmology is not readily available. The emergent lateral canthotomy can be a potentially sight-saving procedure."<sup>31</sup> In the setting of the military field environment, this time window can easily lapse prior to presentation to a trained ophthalmologist. Special Forces units are at particular risk due to separation from upper levels of care. In these settings, prompt recognition and treatment by 18D medical sergeants may be required for vision saving care to be provided.

## DIAGNOSIS

In order to undertake proper treatment, it is imperative to recognize the signs and symptoms of acute retrobulbar hemorrhage in the setting of trauma. OCS should always be considered whenever there is impairment of vision following blunt facial trauma.<sup>32</sup> As the pressure increases, patients may experience double vision, nausea, and vomiting. Signs of retrobulbar hemorrhage include a progressively tense and painful proptosis, decreasing ocular motility, asymmetric visual acuity, field restriction on confrontation testing, and decreased pupil responsiveness – including failure to constrict to direct light stimulation or even loss of the consensual response in comparison with the other eye. The eyelids can become tense and edematous, and periorbital or subconjunctival hemorrhage/ecchymosis are frequently present (Figure 1).<sup>24,33</sup> These signs and symptoms are

progressive over minutes and changes should raise suspicion of retrobulbar pathology.<sup>16,34,35</sup>



**Figure 1:** OCS secondary to acute retrobulbar hemorrhage of the left eye sustained from orbital trauma.

In the setting of blunt or penetrating trauma, retrobulbar hemorrhage and OCS may be accompanied by open globe injuries. When evaluating these patients, it is imperative that first responders maintain a high suspicion for globe perforation first. Care should be exercised during examination of the ocular and periorbital structures to avoid undue pressure on the affected eye. Manipulation of the lids should be minimal to limit the risk of extrusion of intraocular contents in the event globe trauma is present. If suspicion remains based on clinical history, or signs of obvious foreign body, irregular globe shape, peaked pupil, visible corneal or conjunctival lacerations, flat anterior chamber, or hyphema, the eye should be protected with a shield and intervention should be left for upper echelons of care. Nevertheless, even in ideal settings, retrobulbar hemorrhage is a *clinical* diagnosis. Treatment cannot wait for imaging to confirm the presence of hemorrhage within the orbit or for on-call ophthalmologic personnel to arrive. Delays for such studies are at the expense of continued ocular ischemia. Definitive care must be undertaken immediately, once the diagnosis of orbital compartment syndrome from retrobulbar hemorrhage is made and the potential of rupture or penetrating injury has been carefully ascertained and ruled out sufficiently to proceed.

## MEDICAL/SURGICAL INTERVENTION

Mild cases of retrobulbar hematoma have been managed with simple observation and medical treatment.<sup>36-38</sup> Acute OCS requires surgical intervention to prevent vision loss.<sup>39</sup> However, there is often reluctance to interfere surgically in cases of orbital hemorrhage. According to Markovits, when imperative, various methods including aspiration, continuous suction, and open orbitotomy by brow and lateral approach can be



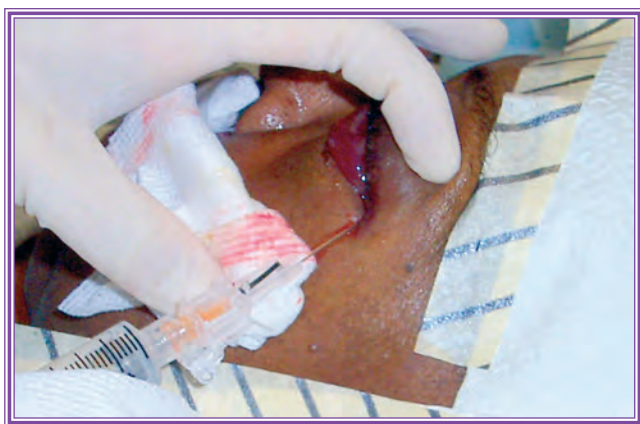
used.<sup>40-42</sup> The goal of treatment for retrobulbar hemorrhage is orbital decompression to release the pressure on sensitive orbital contents — such as the optic nerve and vessels. By far the most common method involves performing a canthotomy and cantholysis of the tendon securing the lateral eyelid. This technique is described in many ophthalmic and surgical texts.<sup>21-23,27,30,34,35,43,44</sup> Performing a lateral canthotomy exposes the lateral canthal tendon, allowing surgical section via cantholysis of the inferior and/or superior crus of the tendon from their natural attachments. This causes laxity of the lower lid and provides a sufficient increase in orbital compartment space to immediately relieve the compressive forces in most instances.

#### TECHNIQUE OF LATERAL CANTHOTOMY AND CANTHOLYSIS

The procedure can be performed in the following step-wise fashion:

**A.** The surgical area of the affected eye should be prepped in sterile fashion if possible. If available, gently clean with 5% betadine; however, due to the immediate nature of the situation, saline irrigation is sufficient if this is not available.

**B.** Pain control and hemostasis are achieved via local injection of approximately 1cc of 2% lidocaine with epinephrine. Using a 27-gauge needle, anesthetize the cutaneous and deep tissues just lateral to the lateral angle of the affected eyelid with the needle directed away from the eye. Care should be taken to inject into the local cutaneous region and NEVER into the eye or orbit itself. The quantity of anesthetic should be sufficient to cover the region between the angle and the bony lateral orbital rim, and additional anesthetic should be applied if the patient is experiencing discomfort (Figure 2).



**Figure 2:** The cutaneous and deep tissues just lateral to the lateral angle are anesthetized with 2% lidocaine with epinephrine.

**C.** Advance the jaws of a small hemostat (one anterior and one posterior to the tissue plane) horizontally across the lateral canthus from the angle of the eyelid to the margin of the lateral orbital rim and clamp shut for one minute. This crushing force will help compress the swollen tissues, provide additional hemostasis, and leave a physical marker of the proper region to be cut during the canthotomy (Figure 3).



**Figure 3:** Clamp a small hemostat horizontally across the lateral canthus from the angle of the eyelid to the margin of the lateral orbital rim.

**D.** After removing the hemostat, advance a pair of blunt tipped scissors with blades open, one anterior and one posterior to the crushed region previously marked. With the scissors, the lateral canthotomy is then performed by cutting horizontally, from the lateral angle of the eyelid to the bony margin of the orbital rim; approximately a 1cm cut (Figure 4).



**Figure 4:** With blunt tipped scissors, cut horizontally from the lateral angle of the eyelid to the bony margin of the orbital rim along the line left by the hemostat.

**E.** The canthotomy allows for additional exposure of the deeper tissue, including the inferior and superior crus of the lateral canthal tendon. Maximize this exposure by gently taking your hemostat or tooth forceps to grasp the lower lid laterally and pull down and away to help evert the lid and expose this tissue plane.

**F.** Identify the now exposed tendon in the surgical field. This can be done more easily by palpation than visually. Using the closed blades of a pair of scissors it is possible to strum the crus in order to further identify the proper structure.

**G.** Once identified, a cantholysis can be performed. Cut the inferior crus of the lateral canthal tendon with the scissors pointed inferoposteriorly to release it completely from its attachment to the lower lid (Figure 5). This incision will be 1-2cm in length and depth. Upon proper cantholysis the lower lid should fall away from the lid margin. If not, repeat this step until the tendon has been released properly and the lid relaxes (Figure 6).



**Figure 5:** Cut the inferior crus of the lateral canthal tendon with the scissors pointed inferoposteriorly to release it completely from its attachments.



**Figure 6:** Upon proper cantholysis the lower lid should fall away from the lid margin.

**H.** Do not close the surrounding tissue. The surgical field can be covered lightly by gently taping a sterile 4x4 gauze pad loosely over the area, but closure should be delayed for a higher echelon of care after the acute retrobulbar hemorrhage has resolved.

## COMPLICATIONS

If properly performed, the risks of this procedure are relatively low. Cosmetic concerns due to the loss of suspension of the lower lid can be addressed at a later date by trained ophthalmologists with excellent results and minimal scarring, despite the delay in closure. Deeper orbital contents can be avoided. Sensitive surrounding structures, including the levator aponeurosis, lacrimal gland, and the lacrimal arteries are found superior to the surgical site and easily avoided with good technique. The key to minimizing surgical complications is recognizing the indications and contraindications for performing orbital decompression, and conducting proper training of first line responders in the correct lateral canthotomy and cantholysis technique.

Lateral canthotomy and cantholysis is performed infrequently in emergency departments; therefore, a laboratory-based curriculum using a swine model was developed to teach emergency medicine residents and pediatric emergency medicine fellows the proper technique and to provide them with hands-on training.<sup>45</sup> The University of Nebraska Medical Center Department of Emergency Medicine has an organized "Emergency Procedures Laboratory" that provides an opportunity to assess procedure skills, including lateral cantholysis, in a controlled environment.<sup>46</sup> Successful use of a porcine model for training has been documented in the literature and would be an excellent option for teaching the proper skill set to forward personnel.<sup>45,47</sup>

## CONCLUSION

Wartime environments task first line providers with the difficult responsibility of providing immediate care to save life, limb, and sight. As described above, the uncommon complication of retrobulbar hemorrhage can quickly become a vision-threatening emergency in patients with facial trauma, particularly when higher echelon assets are unavailable for definitive care. In these circumstances, knowledge of how to recognize and treat this threat to sight immediately upon presentation is necessary for vision preservation.

While the overall incidence may be low, when present it is a blinding condition where visual outcomes could otherwise be saved by well-trained non-ophthalmologists comfortable handling live tissue. Although all first responders do not have the basic training necessary to perform this technique, EMT-P trained providers, such as 18D medical sergeants, have attained a reasonable skill set through prior handling of live tissue from which a method for basic orbital decompression could be appropriately added. In addition, 18D medical sergeants



are more likely to find themselves in austere environments where delayed evacuation would merit the need for such skills. Teaching this subset of first responders how to properly perform a lateral canthotomy and cantholysis would provide them an invaluable tool to better care for their wounded in a timely fashion. This training could occur through the use of live tissue models under supervision, as occurs for emergency physicians in their residency programs. Training 18D medical sergeants to recognize and treat the clinical signs and symptoms of OCS from retrobulbar hemorrhage via this technique brings a potentially vision-saving intervention closer to the Soldier who is in need of emergent care.

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# Tinnitus, a Military Epidemic: Is Hyperbaric Oxygen Therapy the Answer?

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## ABSTRACT

Tinnitus is the phantom perception of sound in the absence of overt acoustic stimulation. Its impact on the military population is alarming. Annually, tinnitus is the most prevalent disability among new cases added to the Veterans Affairs numbers. Also, it is currently the most common disability from the War on Terror. Conventional medical treatments for tinnitus are well documented, but prove to be unsatisfying. Hyperbaric oxygen (HBO<sub>2</sub>) therapy may improve tinnitus, but the significance of the level of improvement is not clear. There is a case for large randomized trials of high methodological rigor in order to define the true extent of the benefit with the administration of HBO<sub>2</sub> therapy for tinnitus.

## THE PHYSIOLOGY OF HEARING

Hearing is a series of events in which sound waves in the air produce electrical signals and cause nerve impulses to be sent to the brain where they are interpreted as sound. The auditory system consists of the external, middle, and inner ears, as well as the central auditory pathways in the brain. Sound waves enter the external ear via the pinna and reach the middle ear where they strike the eardrum and cause it to vibrate. The vibrations set the middle-ear bones (malleus, incus, stapes) in motion. Movement of the stapes causes pressure waves in the fluid contained within the cochlea, which contains the organ of Corti, the sensory organ for hearing. The primary sensory receptors for hearing, the inner hair cells, are found within the organ of Corti as are the outer hair cells, which primarily facilitate the sensory response of the inner hair cells.<sup>1</sup> The fluid in the cochlea moves the top portion of the hair cells, called the hair bundle, which initiates the changes that lead to the production of the nerve impulses. The nerve fibers connected to the hair cells, primarily the inner hair cells, are excited and transfer the auditory information to the brain where they are interpreted as sound.<sup>1,2</sup>

## THE ETIOLOGY OF TINNITUS

Tinnitus, the perception of sound in the absence of an external source, is a chronic and debilitating condition often described as ringing, hissing, buzzing, chirping, high-pitched squealing, or roaring in the ears or in proximity to the head.<sup>2,4</sup> According to the National Research Council, tinnitus is considered a symptom rather than an illness.<sup>2</sup> The perceived noise can be within one or both ears, within or around the head, or perceived as an outside distant noise. It can be pulsatile or nonpulsatile and be continuous or occur in-

termittently. Tinnitus can be caused by or accompany many conditions, including presbycusis, Meniere's disease, otosclerosis, head injury, cerebellar-pontine angle tumors, otitis media, meningitis, dental disorders, and certain medications. However, most tinnitus is due to noise induced sensorineural hearing loss with resulting dysfunction within the auditory system.<sup>2,5,6</sup>

The presence of tinnitus often is an early indicator of cochlear hair cell dysfunction or loss, as in the case of excessive noise exposure.<sup>3</sup> The pathogenesis is assumed to consist of micromechanical traumatic and biochemical-metabolic damage to the outer hair cells.<sup>3</sup> Studies have shown how hair cells of the inner ear react to damage caused by noise.<sup>7,8</sup> In acoustic trauma, defined as an acute impairment of hearing caused by sharp sounds, like that of a gun going off, the partial pressure of oxygen decreases significantly in the fluid spaces of the inner ear.<sup>7</sup> Morphological damage results, leading to intra and extracellular ion imbalances and hearing damage. Histological findings are swelling and structural damage of the dendrites, alterations of mitochondria and the cell-structure, separation of hair-cells from tectorial membrane, oedema of the endothelium, and oedematous closure of functional endarteries with blocking of the microcirculation.<sup>7</sup> If the swelling persists for a prolonged period, the hair cells degenerate and are replaced by non-functioning endothelial cells.<sup>7,9</sup> PET scanning and functional MRI studies indicate that the loss of cochlear input to neurons in the central auditory pathways (such as occurs with cochlear hair cell damage due to noise trauma) can result in abnormal neural activity in the auditory cortex.<sup>3</sup> Such activity has been linked to tinnitus. It is important to note, that sounds of moderate intensity as encountered in everyday life usually do not affect the



oxygen tension within the cochlea.<sup>7</sup> As tinnitus is usually accompanied by hearing loss, similar mechanisms are likely involved.

### THE CHARACTERISTICS OF NOISE

Noise, defined medically as an intense sound capable of producing damage to the inner ear, leads to one of the most common conditions evaluated by otolaryngologist: noise induced hearing loss (NIHL). Noise can be further categorized as impulse noise, the product of explosive devices, or impact noise, caused by a collision of two hard surfaces. However described, both are produced by a sudden intense sound wave capable of causing inner ear damage. Excessive noise exposure is the most common cause of hearing loss.<sup>2,5,6</sup> When an individual is exposed to sounds that are too loud or loud sounds over a long period of time, sensitive structures of the inner ear can be damaged, resulting in NIHL. In humans, outer hair cells are usually the first type of sensory cell to be damaged.<sup>2</sup> As the hearing loss progresses and becomes more permanent, the degeneration involves both outer and inner hair cells. As the number of hair cells decreases, so does an individual's hearing. With severe permanent hearing losses, both sensory and supporting cells of the organ of Corti are missing. In these cases, the degenerative layer of the organ of Corti is replaced by an undifferentiated layer of squamous epithelium and the sensory nerve fibers are destroyed.<sup>9</sup> The type and amount of the resulting hearing loss are typically determined by the following acoustic parameters: the intensity of the noise, the duration of exposure to the noise, and the type of noise.

Intensity of sound is measured in units called decibels (dB), a measurement of the amount of energy or air pressure moving from the source to our ear.<sup>10,11,20</sup>

The faintest sound humans with normal hearing can detect has a value between zero and ten decibels, and the loudest sound the human ear can tolerate without pain is about 120 decibels.<sup>10</sup> Decibels are measured logarithmically, being 20 times the log of the ratio of a particular sound pressure to a reference sound pressure. This means that as decibel intensity increases by units of 20, each increase is 10 times the lower figure. Thus, 20 decibels is 10 times the intensity of 0 decibels, and 40 decibels is 100 times as intense as 20 decibels.<sup>20</sup> The Navy considers any sound above 84dB as noise hazardous and having the potential to cause hearing damage if it is loud enough or lasts long enough.<sup>4,5,10,12</sup> The higher the intensity of the sound, the greater its potential to cause hearing damage. Single exposures to impulse noises above 140 decibels have the potential to cause permanent damage.<sup>4</sup> According to the U.S. Army Center for Health and Preventative Medicine, a gunner on a 105 millimeter towed howitzer experiences an impulse noise of 183dB.<sup>2,4</sup> A servicemember who shoots a rifle is ex-

posed to 157-163dB and a gunner with a machine gun, 145dB.<sup>2,5,10,12</sup> Those suffering from an improvised explosive device (IED) are exposed to impulse noise in excess of 180dB.<sup>13</sup>

Duration is defined as the length of time you are exposed to a noise. The louder the sound and more prolonged the exposure, the shorter amount of time it takes to cause hearing damage. For unprotected ears, the allowed exposure time decreases by one half for each 5dB increase in the average noise level.<sup>5,14</sup> For instance, exposure is limited to eight hours per day at 90dB, four hours per day at 95dB, and two hours per day at 100dB. The highest permissible noise exposure for the unprotected ear is 115dB for 15 minutes per day.<sup>5,14</sup> Sounds of less than 75dB, even after long exposure, are unlikely to cause hearing loss.

Hearing loss that results from exposure to sound with energy spread across a wide range of frequencies, such as impulses common to military settings, is often characterized by a gradual increase in threshold as frequencies increase. The hearing loss typically reaches a maximum between 3000 and 6000 hertz (Hz), followed by a return toward normal hearing at still higher frequencies. This pattern of hearing loss is often referred to as the "noise-notch" audiogram and is a clinical hallmark often used to distinguish noise-related hearing loss from that associated with other etiologies, such as ototoxic medications or aging.<sup>2</sup>

### CHRONIC NOISED-INDUCED HEARING LOSS AND ACOUSTIC TRAUMA

Chronic NIHL is a disease process that occurs gradually over many years of exposure to less intense noise levels. It is generally caused by long term exposure to high intensity continuous noise with superimposed episodic impact or impulse noise. The hearing loss associated with chronic NIHL is variable between individuals, but the principal characteristics remain relatively consistent:<sup>14-17</sup>

- It is always sensorineural affecting the hair cells in the inner ear.
- It is nearly always bilateral and symmetric.
- It will only rarely produce a profound loss.
- It will not progress once noise exposure is stopped.
- The higher frequencies (3000-6000Hz) are more affected than the lower frequencies, with the greatest loss usually occurring at 4000Hz.
- Continuous noise is more damaging than intermittent noise.
- Tinnitus is often associated with NIHL.

One exception to these features would be the individual who had significant noise exposure secondary to rifle shooting. In this case, an asymmetrical loss, with the ear nearest the gun barrel demonstrating slightly worse hearing, would be expected.<sup>14</sup>

The development of chronic NIHL progresses through two phases. A brief hearing loss, more commonly referred to as a temporary threshold shift (TTS), characterizes the first stage. It occurs after noise exposure and completely resolves after a period of rest. Often reported as auditory fatigue, most studies indicate that it is associated with no sensory cell damage or minimal, reversible cell changes.<sup>14,18</sup> Eventually, after repeated exposure to noises intense enough to produce TTS, a permanent threshold shift (PTS) will occur. This is an irreversible increase in hearing thresholds and defines the second stage of chronic NIHL. At this point, there has been irreversible hair cell damage.<sup>5,14,18</sup>

In contrast to chronic NIHL, acoustic trauma refers to a sudden permanent hearing loss caused by a single exposure to an intense sound. It occurs when excessive sound energy strikes the inner ear. Exposure to noise from firearm use during military service is probably the most frequent etiology of acute acoustic trauma worldwide; therefore, it may be regarded as a professional disease in military populations.<sup>19</sup> The sound pressure levels capable of causing acoustic trauma vary between individuals but average around 130-140dB.<sup>14</sup> The hearing loss is sudden, sometimes painful, and is often followed by a new onset of tinnitus. For the vast majority of patients, tinnitus presents as the most annoying symptom, with the risk for permanent tinnitus being considered more critical for the patient than any degree of hearing loss resulting from acoustic trauma.<sup>19</sup> Although the audiogram may show the typical 3000-6000Hz sensorineural notch seen with chronic NIHL, down-sloping or flat audiograms that affect a broad range of frequencies are more common.<sup>2,14,20</sup> Direct mechanical injury to the sensory cells of the cochlea is thought to be the mechanism of injury in acoustic trauma.

Noise exposure and NIHL are the most common cause of tinnitus.<sup>2,5,6</sup> The relationship between noise exposure, NIHL and tinnitus has been addressed in a number of articles. A review of these studies was presented by Axelsson & Barrenas, 1991, and it was found that noise exposure and NIHL were by far the most common cause of tinnitus; if “acoustic trauma” was included, at least one-in-three cases were caused by noise.<sup>6</sup> Tinnitus may occur following a single exposure to high-intensity impulse/impact noise (a short burst of acoustic energy which can either be a single burst or multiple bursts of energy), long-term exposure to repetitive impulses, long-term exposure to continuous noise, or exposure to a combination of impulses and continuous noise.<sup>2,4,6</sup>

#### THE “IMPACT” OF NOISE ON THE MILITARY

A staggering number of Soldiers and Marines caught in roadside bombings and firefights in Iraq and Afghanistan are coming home with ringing in their ears. High rates of tinnitus among patients exposed to

gunfire and explosive detonations suggest that impulse/impact noise is likely to precipitate tinnitus associated with acoustic trauma, excessive noise exposure, and NIHL.<sup>2,4,6,10,12</sup> According to research published in the December 2005 issue of *American Journal of Audiology* (AJA), Soldiers sent to battle zones are over 50 times more likely to suffer NIHL loss and/or tinnitus than Soldiers who do not deploy.<sup>21</sup> According to a report released in 2007 by the House Appropriations Subcommittee on Military Quality of Life, as a result of ongoing combat operations, one in three post-deploying Soldiers report acute acoustic trauma and one in four report hearing loss and/or hearing complaints to include tinnitus.<sup>12</sup>

From World War II and well through the Vietnam War, hearing damage has been a leading disability. According to the Department of Veterans Affairs, hearing damage is the number one disability in the War on Terror, with some experts predicting the true toll could take decades to become clear.<sup>13</sup> According to the American Tinnitus Association (ATA), more will be spent on veterans’ disability compensation for tinnitus and other hearing conditions over the coming years than for any other medical injuries from the Iraq and Afghan wars.<sup>4</sup> Between 2000 and 2005, the number of veterans with tinnitus disabilities more than doubled and the amount paid to veterans with tinnitus disabilities went up more than two-and-a-half times.<sup>4,22</sup> Presently, tinnitus is the most prevalent disability among new cases added to Veterans Affairs numbers; nearly 70,000 of the more than 1.3 million troops who have served in Afghanistan and Iraq are collecting disability for tinnitus.<sup>13,23</sup> In fact, recent studies demonstrated that 49-50% of all Soldiers exposed to explosive blasts in Iraq and Afghanistan had tinnitus and 60% had tinnitus, often related to hearing loss.<sup>4,13,22,24</sup> The number of servicemembers on disability because of hearing damage is expected to grow 18% a year, with payments totaling \$1.1 billion annually by 2011.<sup>4,13</sup>

The economic consequences to the military for hearing impairment, to include tinnitus, include lost time and decreased productivity, loss of qualified workers through medical disqualification, military disability settlements, retraining, and expenses related to medical treatment such as hearing aids and audiometric testing.<sup>10</sup> While the economic consequences are significant, the military implications in a combat zone can be deadly.

A study published in the Army RD&A Bulletin in 1990, concluded that those with hearing impairments were 36% more likely to hear the wrong command, and 30% were less likely to correctly identify their target.<sup>4</sup> Additionally, it was noted that Soldiers with hearing impairments only hit the enemy target 41% of the time, while Soldiers without hearing impairments hit the enemy target 94% of the time. Those with hearing impairments were 8% more likely to take the wrong tar-

get shot and 21% more likely to have their entire tank crew killed by the enemy.<sup>4</sup>

Hearing damage has been a battlefield risk ever since the introduction of explosives and artillery, and the U.S. military recognized it in Iraq and Afghanistan and issued earplugs early on. But the sheer number of injuries and their nature, particularly the high incidence of tinnitus, came as a surprise to military specialists and outside experts. According to VA figures, despite all that has been learned over the years, U.S. troops are suffering hearing damage at about the same rate as World War II veterans.<sup>13,21</sup> Given today's unpredictable weaponry (i.e. roadside bombs), even the best hearing protection is only partly effective, and only if it's properly used.

It makes more sense to prevent hearing damage than to provide a lifetime of disability, but even hearing protection has its limits and it is important to note that some hearing impairments are unavoidable despite use of hearing protection and other measures. Some exposures are so extreme that they will exceed the protective capability of hearing protective devices. As previously noted, damage can occur at 85 decibels. The best protection cuts that by only 20-25dB.<sup>13</sup> That is not enough to protect the ears against an explosion or a firefight, which can range upwards of 180+ dB. Furthermore, much of the fighting consists of ambushes, bombings, and firefights, which come suddenly and unexpectedly, giving Soldiers little time to use their issued hearing protection. In addition, some Infantrymen resist or refuse to wear their hearing protection for fear of dulling their senses and missing critical commands or sounds that can make the difference between life and death.

### **HBO<sub>2</sub> THERAPY EFFICACY IN TINNITUS**

Medical treatments for tinnitus are well documented and there is probably no other disease for which such a variety of treatments have been proposed. Yet, still today, many different treatment regimens are being propagated. Vasodilators, vitamins, steroids, anticoagulants, heparin, histamine, tranquilizers, diuretics, prostacyclin, hypervolemic hemodilution, carbogen, and stellate ganglion block.<sup>3,25</sup> Whether applied separately or together, all have demonstrated limited effectiveness at best. Experimentally, rheological agents and plasma expanders neither cause an improvement in inner ear blood supply nor result in a higher oxygen supply in the inner ear.<sup>26</sup> In addition, two forms of tinnitus rehabilitation are currently being prescribed, tinnitus masking and psychological treatment; both offer symptomatic treatment, with the goal of treatment being only to lessen the awareness of tinnitus and its impact on quality of life.

Since the end of the 1960s, hyperbaric oxygen (HBO<sub>2</sub>) therapy has been used experimentally for certain acute and chronic illnesses of the inner ear.<sup>25</sup> The

role of HBO<sub>2</sub> in the treatment of tinnitus was investigated in the past: Pilgramm et al. in 1985, firstly, and Schumann et al. in 1990, secondly, reported about HBO<sub>2</sub> usefulness in tinnitus treatment, reporting an improvement of 62.2% in 557 patients' tinnitus after receiving 10 applications of HBO<sub>2</sub> therapy.<sup>25,27</sup> While skepticism remains high in the United States, physicians in Germany and Japan continue to recognize its clinical applications in diseases of the inner ear and have demonstrated improved outcomes in the treatment of acute acoustic trauma, NIHL, and tinnitus using HBO<sub>2</sub> therapy.<sup>7,26</sup> The rationale for this therapy is based on the oxygen transportation mechanism in human organisms.

The basis for hyperbaric oxygenation is the breathing of pure oxygen at a pressure which is increased compared to atmospheric pressure (1.0 ATA).<sup>9,26,28-30</sup> The effectiveness of high pressure oxygen therapy is based on raising the partial pressure of oxygen in the blood and thus the pressure difference to tissue. The concentration of oxygen in the atmosphere is 21%. At 1.0 ATA, the oxygen in blood is almost entirely carried by hemoglobin. Because hemoglobin is approximately 97% saturated under normal conditions, greatly increasing the oxygen-carrying capacity of blood by increasing hemoglobin saturation is not possible.

During hyperbaric oxygen therapy the patient sits inside a pressurized chamber. Air pressure inside the chamber is increased up to 2.5 times normal atmospheric pressure at sea level (2.5 ATA). The patient then breathes pure oxygen from a mask. Inhalation of hyperbaric oxygen can enhance the amount of oxygen carried in blood by increasing the quantity of oxygen dissolved in plasma. When breathing 100% oxygen at a surrounding pressure of 2.5 ATA, the quantity of dissolved oxygen in 100ml of plasma increases from 0.3ml, to 6.8ml, which is approximately 20 times higher than normal.<sup>9,26</sup>

The driving force for oxygen diffusion from the capillaries to tissue can be estimated by the difference between the partial pressure of oxygen on the arterial side and the venous side of the capillaries. The difference in the partial pressure of oxygen from the arterial side to the venous side of the capillary system is approximately 37 times greater when breathing 100% oxygen at 3.0 ATA than air at 1.0 ATA.<sup>29</sup>

The increased tissue oxygenation achieved during HBO<sub>2</sub> therapy can support poorly perfused and hypoxic areas. Under this increased pressure, the amount of dissolved oxygen is sufficient, even without hemoglobin, to supply body tissues with oxygen by diffusion. With an increase of the pressure of oxygen in the inner ear, it is possible to influence the auditory sensory cells (inner and outer hair cells) and the peripheral auditory nerve fibers.<sup>30</sup> These cells have no direct vascular supply and depend entirely on oxygen



supplied by diffusion. During exposure to HBO<sub>2</sub> therapy, the oxygenation in the cochlea increases by 460-600% and is still 60% above normal one hour after termination of the therapy.<sup>9,26,30</sup> An increase in oxygen pressure can compensate for oxygen deficiency caused by trauma and gives rise to biological mechanisms which can facilitate cellular and vascular repair.<sup>9,30</sup> Additionally, HBO<sub>2</sub> therapy has been shown to improve hemorheology by causing a reduction in hematocrit, a reduction of platelet aggregation, and an increase in the flexibility of erythrocytes.<sup>31</sup> Hyperoxia has also been shown to reduce edema by reducing vascular permeability and causing a rapid and significant vasoconstriction.<sup>29</sup>

HBO<sub>2</sub> is considered a relatively benign intervention with few adverse effects. Visual disturbance, usually reduction in visual acuity secondary to conformational changes in the lens, and barotrauma, affecting the middle ear, are the most frequently reported complications.<sup>15,16,29</sup> The majority of patients recover spontaneously over a period of days to weeks from their visual disturbances and most episodes of barotrauma do not require the therapy be abandoned. Barotrauma of the middle ear can be treated by placement of pressure equalization tubes or milder cases with decongestants and/or instruction regarding pressure equalization techniques. Less commonly, estimated only to occur in one in 5,000 to 11,000 treatments, HBO<sub>2</sub> may be associated with acute central nervous system oxygen toxicity.<sup>15,16,29</sup> Exposure to 100% oxygen at 3.0 ATA for three hours induces grand mal seizures in most people; at less than 3.0 ATA, seizures are rare.<sup>29</sup> Oxygen-induced seizures are typically benign and produce no long-term sequelae. Additional complications include barotraumas affecting the dental cavities and sinuses, pulmonary barotraumas, drug reactions, and injuries or death related to chamber fires. Decompression sickness can also occur, though rare in patients breathing 100% oxygen with short air breaks.

## CURRENT LITERATURE

The evidence for HBO<sub>2</sub> therapy for acute and chronic tinnitus based on randomized controlled trials is poor. In July 2004, Bennett et al. underwent an extensive search of what they considered to be "suitable" randomized human trials assessing the outcome of tinnitus with HBO<sub>2</sub> therapy. The inclusion criteria consisted of a randomized controlled study, a review with new data, was not a comparative trial in which all subjects/groups received HBO<sub>2</sub> therapy, subjects were randomly allocated, and report was not a case study.<sup>15,16</sup> The initial search identified six randomized human trials meeting the criteria. However, after appraisal of the full report, three articles were excluded because they did not contain new data. A follow-on search was conducted by Bennett et al. in 2006; no additional studies were identified.<sup>16</sup> Using the same inclusion criteria, the

author of this paper was unable to identify any additional studies that met all the criteria, but was able to find a number of prospective and retrospective studies evaluating the benefits of HBO<sub>2</sub> therapy for the treatment of tinnitus.

## PROSPECTIVE STUDIES

Two of the randomized controlled trials, identified by Bennett et al., reported on improvements in tinnitus for patients with an early/acute presentation.<sup>15,16,26</sup> The Hoffmann et al. 1995a trial contributed 20 subjects with idiopathic sudden sensorineural hearing loss (ISSHL) with or without tinnitus; all subjects had no improvement after 14 days of pharmacological treatment with hydroxyethyl starch, pentoxifylline, and cortisone. The Schwab et al. 1998 trial contributed 33 subjects with sudden hearing loss and tinnitus seen within two weeks of onset of tinnitus and without any prior therapy. In each study the HBO<sub>2</sub> group's therapy consisted of 100% oxygen at 1.5 ATA for 45 minutes daily, five days each week for two to four weeks (10 to 20 sessions). The control groups underwent no treatment. While the two trials reported a greater mean improvement in tinnitus (using a visual analogue scale between 0 and 10) in the HBO<sub>2</sub> arm compared to the control arm, statistical pooling was not possible due to the authors neglecting to report the standard deviation around the means. As a consequence, clinical significance could not be determined.

The third article considered suitable, by Hoffmann et al. 1995b, was the only randomized human controlled trial reporting on improvements in tinnitus for patients with a chronic presentation.<sup>15,16</sup> This study contributed 44 subjects with ISSHL and tinnitus for longer than six months. HBO<sub>2</sub> therapy consisted of 100% oxygen at 1.5 ATA for 45 minutes daily, five days each week for three weeks. The control group breathed air at 1.5 ATA on the same schedule as the HBO<sub>2</sub> group. While the HBO<sub>2</sub> therapy group did demonstrate some improvement in tinnitus, the improvement did not reach statistical significance:  $p=0.12$ .<sup>15,16</sup>

In each of these studies the HBO<sub>2</sub> therapy consisted of breathing 100% oxygen at 1.5 ATA for 45 minutes. In studies reporting significant improvements, HBO therapy consisted of breathing 100% oxygen at 2.0 to 2.5 ATA for 90 minutes.

In 2007, a comparative trial by Porubsky et al. evaluating the influence of time interval from the onset of tinnitus until the first HBO<sub>2</sub> therapy was published.<sup>31</sup> In addition to time interval, the study compared the influence of other factors: treatment protocols, gender, noise characteristic, and pretreatment expectations. This author will only comment on treatment protocols and time interval from tinnitus onset to treatment.

In this study, 360 patients suffering from tinnitus were randomized into two HBO<sub>2</sub> treatment pro-

protocols: group A: 2.2 ATA for 60 minutes and group B: 2.5 ATA for 60 minutes. Both series were administered once a day for 15 consecutive days; 156 patients underwent protocol A and 156 protocol B. Forty-eight patients were treated inconsistently, leaving out single days of treatment. No patient had less than twelve HBO<sub>2</sub> sessions. One month after the end of HBO<sub>2</sub> treatment, the therapeutic effect was evaluated according to the patient's subjective assessment of tinnitus. A non-treatment control group was not identified. In 92 patients HBO<sub>2</sub> therapy was started within the first two weeks after the onset of tinnitus; in 93 there was a delay between two weeks and six months; in 41 cases the delay was 6-12 months; and in 126 patients more than one year elapsed between the onset of tinnitus and HBO<sub>2</sub> treatment. Eight patients did not answer the question.

A complete remission of tinnitus was reported by 12 (3.3%) subjects, 122 (33.9%) felt a decrease in intensity, 157 (56.3%) patients did not notice any changes and 25 (6.9%) patients complained that their tinnitus became louder after HBO<sub>2</sub>.<sup>31</sup> Out of the 12 patients who had a complete remission of tinnitus, 10 (83.3%) had HBO<sub>2</sub> within the first two weeks after the onset of tinnitus and two (16.6%) later than two weeks but within the first six months. Out of the 122 patients who felt that their tinnitus had lessened, 37 (30.3%) had HBO<sub>2</sub> therapy within the first two weeks after the onset and 39 (31.9%) were treated within the first six months. Only nine (7.4%) who started HBO<sub>2</sub> six to twelve months after the onset of tinnitus had improvement and thirty-four (27.9%) felt a lessening of tinnitus after more than twelve months delay until HBO<sub>2</sub>.<sup>31</sup>

The authors determined there was no statistically significant difference between treatment groups A and B ( $p > .05$ ). Furthermore, they concluded there is no statistically significant difference between the time intervals until the start of HBO<sub>2</sub> therapy.<sup>31</sup>

This study compared a treatment protocol of 2.2 ATA for 60 minutes to a treatment protocol of 2.5 ATA for 60 minutes. This study could have been enhanced if it would have compared two groups in which there was a bigger difference between treatment protocols (i.e. one group breathing 100% oxygen at less than 2.0 ATA) and/or included a non-HBO<sub>2</sub> therapy control group. Additionally, the study grouped patients into a treatment group receiving therapy within the first two weeks after onset of tinnitus and one in which the patient received therapy later than two weeks but within the first six months. Again the authors reported no statistical significant difference between the time intervals until the start of HBO<sub>2</sub> therapy. Most studies group subjects into those suffering from tinnitus for three months or less and those suffering from tinnitus for greater than three months, but less than six months. Of the 122 patients treated, 39 (31.9%) who were treated within the first six months, but after two weeks

from the onset of their tinnitus, reported improvement. Of the 39, how many were treated within three months from the onset of their tinnitus, and if added to those who demonstrated improvement if treated within two weeks from the onset of their tinnitus, would a significant difference between time intervals be seen?

In a study published in 2003 by Narozny et al., 61 patients with tinnitus (29 acute, 32 chronic) underwent HBO<sub>2</sub> therapy with simultaneous pharmacotherapy (group A).<sup>25</sup> HBO<sub>2</sub> therapy was administered once daily at a pressure of 2.5 ATA for 90 minutes (three periods of 20 minutes with two five-minute air breaks and 20 minutes needed for compression and decompression). The patients breathed 100% oxygen throughout the treatment with exception of the two five-minute air breaks. Patients with acute tinnitus underwent  $15 \pm 6$  HBO<sub>2</sub> exposures, patients with chronic tinnitus  $18 \pm 6$  exposures. Before, immediately, and six months after the end of treatment, the level of tinnitus was assessed by means of a visual analog scale (VAS), Vernon's tinnitus severity scores (VTSS), and questionnaire by Tyler and Baker. The obtained results were compared with 122 patients (group B) with tinnitus (70 acute and 52 chronic) treated only pharmacologically. Tinnitus improvement after therapy was stated by comparison of tinnitus level before and after therapy (in percentage).

Satisfactory improvement of tinnitus loudness (more than 50% in comparison to primary state), using the VAS, was demonstrated in 58.6% of patients with acute tinnitus in group A. Of the 58.6% who demonstrated satisfactory improvement, 41.4% showed excellent improvement (75% to 100%) and 17.2% showed some improvement (50% to 75%). No improvement (less than 50%) was seen in 41.4% of the acute tinnitus patients in group A. Comparative analysis of group B subjects with acute tinnitus reflected 41.4% with satisfactory improvement, 30.0% with excellent improvement, and 11.4% with some improvement. No improvement was noted in 58.6% of the acute tinnitus patients in group B. Satisfactory tinnitus improvement in patients with chronic tinnitus (group A) was 81.3%, 6.3% with excellent improvement, and 75.0% with some improvement. No improvement was noted in 18.7%. Comparative analysis of group B subjects with chronic tinnitus revealed 65.4% with satisfactory improvement, 25.0% with excellent improvement, and 40.4% with some improvement. No improvement was noted in 34.6% of the chronic tinnitus patients in group B.<sup>25</sup> Similar results were obtained by VTSS and questionnaire. After six months, there was an inconsiderable regression of the positive effect of therapy, especially in patients with chronic tinnitus, in group A as well as in group B.

The authors (Narozny et al.) concluded HBO<sub>2</sub> therapy may contribute to the treatment of tinnitus, particularly its chronic severe form. Their results were

similar to those of other authors, indicating that HBO<sub>2</sub> therapy can reduce tinnitus even if it has been present for a long time.<sup>25-27</sup>

The authors reported the wrong data for the acute tinnitus group B patients in their results section and unfortunately based their conclusions using the incorrect data. Using the correct data (shown in Table 2 of this study) HBO<sub>2</sub> therapy is shown to be more beneficial in the acute tinnitus stage (group A compared to group B) than it is in the chronic stage (group A compared to group B). While there is a 17.2% difference in satisfactory improvement in acute tinnitus patients comparing group A to group B, there is only a 15.9% difference in satisfactory improvement in chronic tinnitus patients comparing group A to group B.

In a prospective controlled study conducted by Biesinger et al. (1998), 211 cases of acute tinnitus (tinnitus for less than three months) were assessed after receiving one of three treatment protocols.<sup>32</sup> Of the 211 cases of acute tinnitus, 69 patients were treated with haemodilution and cortisone alone and had no HBO<sub>2</sub> therapy. Of the 142 patients that had HBO<sub>2</sub> therapy, 72 of these were after unsuccessful haemodilution.

Of the 69 cases in which the patients received haemodilution only, 36.2% healed completely, 38.8% cases did not notice a change, and 25% of the patients reported a decompensation. Of the 142 cases receiving HBO<sub>2</sub> therapy, 64.1% healed completely, 17.9% experienced no change, and 18% reported a decompensation. Out of the 72 cases receiving HBO<sub>2</sub> therapy after failure of haemodilution, 51.4% healed completely, whereas 37.5% reported improvement, 11.1% experienced no change in their tinnitus, and 0% of the cases worsened.<sup>7,32</sup> The results demonstrated a better outcome for patients with acute tinnitus if they received HBO<sub>2</sub> therapy, especially the high rate of decompensated tinnitus in patients receiving solely haemodilution.

In a study published in 1997 by Delb et al.,<sup>33</sup> a total of 193 patients, having undergone and failed primary intravenous hemorheologic therapy, were treated with HBO<sub>2</sub> therapy. Tinnitus was evaluated before, after ten sessions, and after 15 sessions using a tinnitus questionnaire. Measurable improvements of the tinnitus occurred in 22% of the patients, moderate improvement in 17% of cases, excellent improvement in 10.4% of cases and complete resolution in two patients.<sup>33</sup> Though clinical significance was not reported, the improvement rate decreased in those cases where the time from onset of tinnitus exceeded 40 days. In addition, while the improvement rate slightly increased in patients receiving 15 sessions compared to those receiving 10 sessions, the clinical significance, once again, was not reported. The authors concluded that HBO<sub>2</sub> therapy seems to be a moderately effective additional treatment in the therapy of tinnitus after primary hemorheologic therapy, provided the time from onset of tinnitus is less than one month.<sup>33</sup>

In another study published in 1997 by Kau et al.,<sup>26</sup> 355 patients with tinnitus, who had not responded to treatment with medications, were given HBO<sub>2</sub> therapy. Of the 355 patients, 192 suffered from tinnitus for less than three months and 163 suffered from tinnitus for more than three months. HBO<sub>2</sub> therapy consisted of a pressure increase phase of 20 minutes, at the end of which a diving depth of 2.5 ATA was reached. This pressure was held for 70 minutes which was then followed by an ascent phase lasting 20 minutes. Pure oxygen was inhaled by mask during the entire treatment period. The number of treatments was not reported and a non-HBO<sub>2</sub> therapy control group was not identified. Subjective evaluation of tinnitus was expressed by means of a visual analog scale.

For the patients in whom the first episode of tinnitus was within three months before HBO<sub>2</sub> therapy, excellent improvement was seen in 6.7%, noticeable improvement in 44.3%, unchanged in 44.3%, and a temporary increase in the severity of tinnitus in 4.7%.<sup>26,30</sup> Patients who had tinnitus for more than three months before HBO<sub>2</sub> therapy showed a less favorable response. In none of the patients did the tinnitus fully resolve. Noticeable improvement was reported by 34.4% of the patients, no change in tinnitus was appreciated by 62% of the patients and an intermittent increase was reported by 3.6% of the patients.<sup>26,30</sup>

The authors feel the results justify the position that patients, who have been treated unsuccessfully by "conventional" means, may still have a chance of improvement in their symptoms when they can be given HBO<sub>2</sub> therapy within three months of the onset of their tinnitus.<sup>26</sup>

In 1997, an article by Bohmer was published reporting on two prospective studies conducted at the Institute for Hyperbaric Medicine, Orthopaedic University Clinic, Frankfurt, Germany.<sup>28</sup> In the first study, 47 patients received HBO<sub>2</sub> therapy within three months of tinnitus first occurring. In each case they received pharmacotherapy often combined with cortisone prior to undergoing HBO<sub>2</sub> therapy. In 64% of the cases an improvement was attained. During the follow-up examinations 27% of the patients confirmed a further decrease of the ringing in their ears during the two months following treatment.

In the second study, 381 patients underwent HBO<sub>2</sub> therapy for the treatment of their tinnitus. On average 15 single treatments for 90 minutes with a pressure of 2.2 to 2.5 ATA were carried out. Daily, at the same time each day, the patients were asked to subjectively annotate their sound volume. Complete resolution of tinnitus was seen in 3.9% of the patients. Noticeable improvement was seen in 34.1%, slight improvement in 31.8%, no improvement in 28.1%, and worsening of tinnitus in 2.1% of the patients.<sup>28</sup> With HBO<sub>2</sub> therapy, the improvement of tinnitus sound from "becoming less" to "being completely healed" was ap-



preciated in the first six months of tinnitus first occurring. The major advances starting with “unbearably loud” to “bearable” were made during the first two to three months.

The author recommends that HBO<sub>2</sub> therapy should be liberally applied when infusion therapy shows no success. Even after four to six months successful results were obtained with tinnitus patients.<sup>28</sup>

## RETROSPECTIVE STUDIES

In 1998, Lamm et al., and in 2003, Lamm reported on a retrospective meta-analysis of 50 clinical studies carried out on a total of 4,109 patients who received HBO<sub>2</sub> therapy following unsuccessful conventional treatment with drugs for patients suffering from tinnitus.<sup>30,34</sup> Providing the onset of the disorder was longer than two weeks but not longer than six weeks, 4% of the patients suffering from tinnitus reported complete resolution, 81.3% observed a decrease in tinnitus intensity, 13.5% reported no change and 1.2% reported a temporary increase in tinnitus.<sup>30,34</sup> These results were confirmed in some of the prospective studies described above as well as additional studies by Nakiashima et al. (1998), Shiraishi et al. (1998) and Murakawa et al. (2000).<sup>26,33</sup> The authors concluded that HBO<sub>2</sub> therapy is recommended and warranted in those patients treated within three months of the onset of symptoms.<sup>30,34</sup>

In a retrospective evaluation of 7766 patients in 13 publications showed reduction of the molestation and intensity of tinnitus by 50% in approximately 70% of the cases (30%-88%) if treated within the first three months.<sup>7,9,35</sup> Chronic tinnitus with duration of more than three months or bilateral manifestation showed improvement rates of 50% in around 30% of the cases after ineffective conservative treatment. Follow-ups showed no change in 12 months.

An additional retrospective study published by Hoffmann et al.<sup>28</sup> 250 patients who had been treated unsuccessfully with infusion therapy received HBO<sub>2</sub> therapy. These subjects were compared to patients who did not receive HBO<sub>2</sub> therapy. The subjects were under observation for 21 months. In this study, 60% of patients undergoing HBO<sub>2</sub> therapy ascertained a steady tinnitus improvement. Other HBO<sub>2</sub> therapy centers have also shown good results; Almeling et al. (1996), Dauman et al. (1985), Meazza et al. (1996), and Takahashi et al. (1989).

## DISCUSSION

Tinnitus is the phantom perception of sound in the absence of overt acoustic stimulation.<sup>36</sup> Its impact on the military population is alarming. Annually, tinnitus is the most prevalent disability among new cases added to Veterans' Affairs rolls and is currently the number one disability in the War on Terror. There is more being spent on veterans' disability compensation

for tinnitus than on any other disability, with payments expecting to reach \$1.1 billion annually by 2011.<sup>4,13</sup>

A considerable number of therapies have been proposed since tinnitus first appeared in medical literature. However, the results of established, conservative medical treatment regimes for tinnitus are unsatisfying. It has been shown that common pharmacological treatment does not yield better results than placebo therapy.<sup>30,31,36</sup> The knowledge of hyperbaric oxygen therapy for the hyperoxygenation of tissue has led to further development of medical indications over the past 50 years. Indications for ENT therapy include decompression trauma of the inner ear, idiopathic sudden hearing loss, acute acoustic trauma, acute noise-induced hearing loss, osteoradionecrosis and osteomyelitis, otogenic infection of the skull base, and otitis externa maligna.<sup>30</sup> HBO<sub>2</sub> treatment increases the inner ear pO<sub>2</sub>; decreases hematocrit, plasma viscosity, and platelet aggregation, and improves microcirculation.<sup>29,30,37</sup> In spite of its clear-cut rationale, an effectiveness of HBO<sub>2</sub> therapy has not been objectively documented for tinnitus and its use in the United States has not been widely applied (this is not approved by the Undersea and Hyperbaric Medicine Society). Due to the low number of recognized, controlled, double-blind clinical trials demonstrating the effectiveness of HBO<sub>2</sub> therapy for tinnitus, this therapy lacks official recognition and skepticism remains high. Poor methodological quality in many of the reported trials, variability and poor reporting of entry criteria, the inconsistent nature and timing of outcomes, and poor reporting of both outcomes and methodology make comparisons and meta-analysis impossible. In addition, treatment protocols and patient inclusion criteria are not standard, and poorly reported in some trials. No standard severity scale is employed across these trials, and the time to entry varies from within hours to years. Many of the patients were negatively selected, they had already been treated by various methods and only those who had not responded to these therapies were treated with HBO<sub>2</sub> therapy. Moreover, many of the studies neglected to identify a control group and many did not assess HBO<sub>2</sub> as a monotherapy.

## CONCLUSION

Many of the reports indicate the effectiveness of HBO<sub>2</sub> therapy for tinnitus, but a majority of them are retrospective and many suggest using HBO<sub>2</sub> therapy as an adjuvant to standard medical treatment. Nonetheless, the results justify the position that patients with tinnitus, who have been treated conventionally, may still have a chance of improvement of their condition when they can be given HBO<sub>2</sub> therapy within three to six months. These studies have shown that hyperbaric oxygenation treatment can suppress acute and even longer existing tinnitus. It appears that during the first six months, HBO<sub>2</sub> therapy has a positive and

promising effect on tinnitus. However, the most significant improvement in tinnitus is notable when HBO<sub>2</sub> therapy is administered within the first three months at pressures between 2.0 and 2.5 ATA.

## FUTURE RESEARCH

Because of its subjective nature, assessing the level of distress remains the primary impediment in the appraisal of tinnitus studies. In patient studies, differences in the level of tinnitus, duration, medical history, and involvement of etiological factors in the initiation and mental habituation may obscure any correlation with a treatment outcome.<sup>38</sup> There is a case for large randomized trials of high methodological rigor in order to define the true extent of the benefit (if any) from administration of HBO<sub>2</sub> therapy to patients suffering from tinnitus. A critical multicenter analysis with identical documentation of a large number of patients should establish the therapeutic value of HBO<sub>2</sub> therapy for well defined groups of patients. In addition, further studies to evaluate the actual effect of HBO<sub>2</sub> therapy should concentrate on the development of double-blind, case controlled trials.

Though the authors of several studies report various degrees of improvement in up to 50% to 70% of patients undergoing HBO<sub>2</sub> therapy, actual cure of tinnitus is rare. In no study was it reported to be greater than 3.9%. If HBO<sub>2</sub> therapy is scientifically established to be beneficial in the treatment of tinnitus, cost analysis for treating tinnitus versus paying out VA benefits should be conducted. Will curing approximately 4% of cases significantly reduce VA compensation for tinnitus and/or will a significant reduction in a patient's tinnitus affect VA compensation? A final evidence based recommendation will be possible after conclusion of several randomized, controlled, double-blind studies. Currently, there are six major prospective trials being carried out in Germany.<sup>7,9</sup>

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# Brain Natriuretic Peptide Levels in Six Basic Underwater Demolitions/SEAL Recruits Presenting with Swimming Induced Pulmonary Edema (SIPE)

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## ABSTRACT

Swimming induced pulmonary edema (SIPE) is associated with both SCUBA diving and strenuous surface swimming; however, the majority of reported cases and clinically observed cases tend to occur during or after aggressive surface swimming.<sup>1</sup> Capillary stress failure appears to be central to the pathophysiology of this disorder. Regional pulmonary capillaries are exposed to relatively high pressures secondary to increased vascular volume, elevation of pulmonary vascular resistance, and regional differences in perfusion secondary to forces of gravity and high cardiac output.

Acute pulmonary edema can be classified as either cardiogenic or noncardiogenic or both. Cardiogenic pulmonary edema occurs when the pulmonary capillary hydrostatic pressure exceeds plasma oncotic pressure. Noncardiogenic pulmonary edema occurs when pulmonary capillary permeability is increased. Given the pathophysiology noted above, SIPE can be described as a cardiogenic pulmonary edema, at least in part, since an increased transalveolar pressure gradient has been implicated in the pathogenesis of SIPE.<sup>2</sup>

Brain natriuretic peptide (BNP) is used in the clinical setting to differentiate cardiac from pulmonary sources of dyspnea, specifically to diagnose cardiogenic pulmonary edema.<sup>3,4</sup> During clinical management, BNP levels were drawn on six BUD/S recruits simultaneously presenting with pulmonary complaints consistent with SIPE, after an extended surface bay swim. This paper analyzes that data after de-identification and reviews the pathophysiology and clinical management of SIPE.

## LEARNING OBJECTIVES

1. Describe the signs and symptoms of SIPE.
2. Describe the immediate care and treatment of SIPE.
3. Demonstrate understanding of the fundamental pathophysiology of SIPE.

## BACKGROUND

The pathophysiology of SIPE is multifactorial. Numerous physiologic, environmental, and behavioral factors have been implicated. However, capillary stress failure appears to be central to the pathophysiology of this condition. The pulmonary capillary measures approximately two to six microns in diameter. This structure has the difficult task of facilitating gas transfer between the alveoli and pulmonary vasculature whilst maintaining structural integrity. Capillary stress failure occurs when the capillary is exposed to relatively high transmural pressures.

Intense exercise is capable of generating these elevated pressures. Stress fracture of the pulmonary capillaries has been documented with electron microscopy in equine models when exposed to capillary transmural pressures of 75-100mmHg. Additionally, necropsy of equine athletes has demonstrated evidence of pulmonary capillary stress failure.<sup>5</sup> Lower pressures are required to cause fracture in canines and rabbits (40mmHg) and likely in man.<sup>6</sup>

Elite human athletes are capable of generating mean pulmonary artery pressures of 37mmHg. Reeves

et al. demonstrated that both right atrial and wedge pressures rise with heavy exercise in normal men with some wedge pressures measured greater than 30mmHg. They surmised that these high cardiac filling pressures “could contribute both to elevated pulmonary arterial pressure and to increased filtration of water into the lung.”<sup>7</sup> Bernheim et al. demonstrated exercise induced increases in systolic right ventricular to atrial pressure gradients (RVPGs) in 39 subjects. Of note, individuals susceptible to high-altitude pulmonary edema (HAPE) demonstrate greater increases in RVPG from baseline than normal controls.<sup>8</sup>

Bronchoalveolar lavage (BAL) findings in such athletes indicate elevated levels of protein and red blood cells. Intense exercise impairs the integrity of the blood-gas barrier in elite athletes. Vigorous exercise not only may result in increased RBCs and total protein on BAL, but also a lack of pro-inflammatory markers. This supports the hypothesis that the insult to the barrier is mechanical.<sup>9</sup> Ludwig et al., demonstrated BAL evidence high molecular weight protein edema fluid and red blood cells consistent with capillary fracture, in five BUD/S trainees diagnosed with SIPE.<sup>10</sup>

The factors that lead to elevated pulmonary artery pressures and capillary fracture are both physical and physiological. Partial immersion, gravity dependent flow in the pulmonary vasculature, and extreme exertion combine to elevate pulmonary artery pressures beyond physiologic norms and lead to failure of the pulmonary capillary.

Head above water immersion has both cardiovascular and pulmonary effects. Increased venous return leads to central pooling of blood, which thereby increases cardiac preload.<sup>11</sup> Additionally, immersion independently leads to elevated pulmonary artery pressures. Arborelius et al., described a 700cc increase in thoracic blood volume and a 32% increase in cardiac output along with elevations of mean pulmonary artery pressure associated with head above water immersion.<sup>12</sup> Exercise with head out immersion leads to significantly greater stroke volume and cardiac output when compared with exercise on land.<sup>13</sup> Additionally, immersion alone increases sympathetic activity, thereby contributing to additional peripheral vasoconstriction and central pooling of blood volume.

Water temperature may have a role in SIPE as well. Immersion in cold water is known to cause peripheral vasoconstriction. Conceivably, this could contribute to increased vascular resistance (afterload), as well as contribute to the central pooling of blood (preload). Cold-water immersion has been demonstrated to increase central vascular volume and forearm vascular resistance and cold showers have been documented to increase pulmonary vascular resistance and increase cardiac output by as much as 59-100%.<sup>14,15</sup>

The pulmonary effects of immersion are also prominent, such as decreased vital capacity, decreased

functional residual capacity, and increased closing volume. These effects induce a non-uniform pulmonary vasoconstriction. Capillaries not protected by arterial constriction experience high pressures and are prone to micro-fracture. Negative pressure breathing of head out immersion results in an alveolar pressure less than mouth pressure. This produces hydrostatic forces that favor a fluid shift from the vasculature to the alveoli.<sup>16</sup>

There is a 65% increase in respiratory work associated with immersion to the xiphoid process compared with immersion to the neck.<sup>17</sup> Extreme effort, induced by both intense swimming and this increased work of breathing, could increase peak airway pressures and result in increased capillary permeability.<sup>18</sup>

Gravity dependent flow in the pulmonary vasculature is an additional contributing factor to SIPE. There is a 200% increase in perfusion in the gravity-dependent lung, while swimming in the lateral decubitus position.

This combination of cardiovascular and pulmonary effects can increase capillary transmural pressure via a decrease in the amount of capillary bed available for thoracic blood to flow through. Additional contributing factors have been proposed. Over-hydration could reasonably be presumed to increase central blood volume and increase preload, thus predisposing to elevated pulmonary pressures and capillary fracture. Weiler-Ravell et al. described six cases of SIPE occurring in Israeli soldiers after the individuals drank five liters of water in the two hours preceding the exercise. His team deduced that over-hydration was a contributing factor in these cases.<sup>19</sup> Finally, constrictive wet suits have also been implicated as a causative agent in at least one case report of SIPE.<sup>2</sup> Presumably, the causality in this case would be similar to the effects of submersion, resulting in increased work of breathing. Of note, there is also evidence that tight-fitting wetsuits likely do not play a significant role in SIPE, as evidenced by the lack of significant influence on pulmonary function studies.<sup>20</sup>

Brain natriuretic peptide (BNP) is secreted by myocardial ventricular cells, mainly cardiomyocytes. BNP is known to have natriuretic, diuretic, and vasorelaxant properties. It plays an important role in fluid homeostasis and blood pressure. Elevations in BNP reflect myocardial wall stress and are often in response to high ventricular filling pressures. Numerous studies have shown elevations in plasma BNP levels in left ventricular systolic and diastolic dysfunction, left ventricular hypertrophy, and right ventricular dysfunction in pulmonary hypertension, cardiomyopathy, acute coronary syndromes, and pulmonary embolism.<sup>21-23</sup> Additionally BNP correlates with pulmonary artery pressures.<sup>24</sup>

BNP levels have been utilized clinically in differentiating cardiac from non-cardiac causes of dyspnea. Berdague et al. demonstrated that NT-proBNP is a sensitive and specific means of distinguishing pulmonary from cardiac causes of dyspnea in elderly patients. They demonstrated 86% sensitivity and 71% specificity with



overall accuracy of 80% for cardiac dyspnea.<sup>4</sup> Additionally, brain natriuretic peptide has a sensitivity of 82% and specificity of 92% for identification of cardiac causes of syncope, when a cut-off value of 40pg/ml is used.<sup>25</sup>

It is of note, that resting BNP concentrations are not elevated in physiologically hypertrophied hearts of endurance athletes.<sup>26</sup>

## CLINICAL CONSIDERATIONS

Typical symptoms of SIPE include dyspnea, cough which may be productive of pink or white frothy sputum, chest pain or tightness, and hemoptysis. Upon initial symptom onset, patients may exhibit confusion secondary to hypoxemia. Typical signs include labored breathing, tachypnea, and hypoxemia.

SIPE can be confidently diagnosed in any patient presenting with the above noted signs and symptoms occurring during or immediately after a swimming event, in association with a demonstrable chest radiograph abnormality. The treatment of SIPE is primarily supportive. It is imperative to deliver supplemental oxygen to the patient, titrated to maintain normal oxygen saturation. In the military setting, Corpsmen or First Responders covering training evolutions with an inherent risk for the development of SIPE, should be equipped with pulse oximetry, supplemental oxygen, and inhaled beta agonists. They should be trained in Basic Life Support (BLS/CPR). Prompt evaluation by a physician with access to radiography, Advanced Cardiac Life Support (ACLS) capability, and laboratory support is important for moderate to severe cases of SIPE. However, there is no evidence in the literature that ACLS has been necessary in the treatment of SIPE.

Clinical experience has shown long acting inhaled beta agonists, such as salmeterol, to be of utility. This agent accelerates resolution via improved alveolar fluid clearance and also provides symptomatic relief to the patient.<sup>16</sup> Diuretics generally are not necessary in the treatment of SIPE.<sup>27</sup>

Occasionally patients with SIPE will require inpatient admission, though frequently patients can be discharged directly from the emergency department after a period of treatment and observation, once oxygen saturation has returned to baseline on room air.

A hallmark of SIPE is rapid resolution. Frequently, symptoms resolve within 12 to 24 hours with chest radiographs demonstrating resolution within 24 to 48 hours. Frequently, patients can be returned to full duty within 72 hours.

Historically, there is no evidence that individuals who suffer from an episode of SIPE are predisposed to have additional occurrences. Typically, BUDS candidates who suffer from SIPE have graduation rates commensurate with their fellow students who have not had a SIPE event. In fact, testing in dry con-

ditions of individuals previously diagnosed with SIPE revealed that they do not have abnormal pulmonary function tests, abnormal exercise capacity, or abnormal pulmonary arterial pressure response to hypoxemia.<sup>10</sup>

There are no definite predisposing factors for SIPE. However, Shupak et al. did demonstrate that baseline FVC, FEV1, and FEF were 25 to 75% lower in twenty-one individuals diagnosed with SIPE. Thus lower initial lung volumes and flows may be predictive of vulnerability to SIPE.<sup>28</sup>

## METHODS

Six BUD/S recruits presented to the ED with pulmonary complaints after a surface bay swim. The diagnosis of SIPE was made on all six individuals based on presenting complaint, chest radiograph findings, and physical examination. BNP levels were drawn on these individuals as part of the clinical evaluation of dyspnea, cough, and pulmonary edema in the emergency department setting. Transport time to the ED was approximately thirty to forty-five minutes from symptom onset. Labs were drawn within two hours of swim termination.

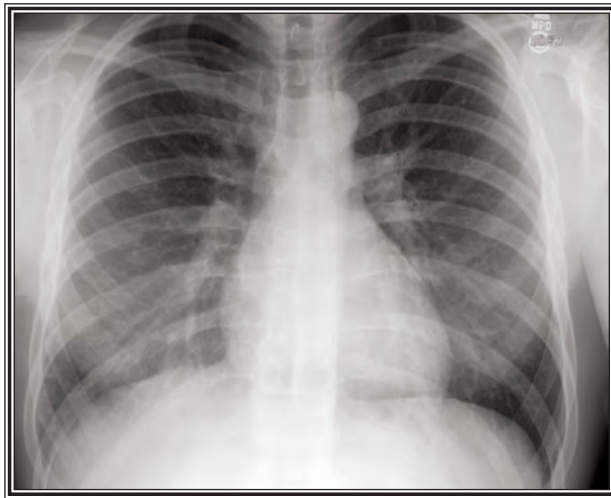
The case definition of SIPE for the purposes of this report is hypoxemia occurring during or immediately after a swimming event, a demonstrable chest radiograph abnormality, improvement or resolution of said abnormality in less than 48 hours, absence of evidence of pulmonary infection, and absence of a history of breathing against a closed glottis or aspiration of water.

## RESULTS AND PATIENT DATA

See Table 1 on page 47

### Results

BNP levels ranged from 6.3pg/ml to 39.7pg/ml. The average was 26.55pg/ml. All values fell within the NMCSL laboratory range of normal, 1-100pg/ml. All six individuals demonstrated abnormal chest radiographs with both interstitial and airspace processes. The cardiac and mediastinal silhouettes were normal in all cases. Three patients were admitted to the internal medicine service. One patient was admitted to the ICU. Two patients were discharged to their command. The patients admitted to the hospital stayed an average of twenty-four hours. Their treatment consisted of supplemental oxygen and beta-agonists (alveolar fluid clearance). All were returned to full duty within seventy-two hours. Two of the six individuals went on to complete BUD/S training and became SEALs. This graduation rate of 33% is consistent with normal rates in individuals attending BUD/S. This likely indicates that a single episode of SIPE does not cause long-term decrements in physical performance from a cardiovascular standpoint.



TYPICAL CHEST RADIOGRAPH FINDINGS IN SIPE: Mixed interstitial & airspace process, prominent pulmonary vasculature, Kerley B-lines, normal cardiac, and mediastinal silhouettes.

**Table 1**

PT	Age (yrs)	Onset of Symptoms	Initial O2 Sat	Chest Radiograph Findings	BNP (pg/ml)	HgB (g/dl)	Disposition
1	28	0.25 miles into swim	89%	Bibasilar interstitial and airspace process	38.5	13.5	Admit to ICU, supportive treatment
2	31	Completed swim	97%	Interstitial prominence in the lung bases	36.9	13.2	DC to command w/ salmeterol
3	23	20 minutes into swim	99%	Mixed interstitial and airspace process	11.1	13.9	DC to command w/ salmeterol
4	25	5 minutes into swim	87%	Mixed interstitial and airspace process	6.3	14.9	Admit to GEN MED, supportive treatment
5	29	45 minutes into swim	87%	Bibasilar diffuse interstitial and air space process	39.7	14.7	Admit to GEN MED, supportive treatment
6	27	Not documented	Not documented	Linear opacities in right lung base	26.8	13.8	DC to command w/ salmeterol

## Discussion of Results

It is well known that BUD/S training is extremely arduous. The extreme physical and psychological demands of the training, in concert with the environment in which the training is conducted, frequently results in illness and injury. Pulmonary infections are relatively common in this population. Therefore, utilization of BNP as a method for differentiating the source of dyspnea in these BUD/S trainees was prudent. Our experience indicates that plasma BNP is not elevated in SIPE. However, these findings may be limited by a delay of up to two hours from symptom onset to blood draw. There is currently little data in the literature describing the amount of BNP reserve in the ventricular cells. The time course for BNP elevations to occur is not incredibly well defined. BNP is significantly elevated above baseline within one hour after ventricular septal defect repair in children and BNP rapidly rises (within hours) in the setting of acute myocardial infarction.<sup>29,30</sup> Serial BNP levels were not drawn in these patients, thus it is theoretically possible that BNP levels may have elevated after initial diagnostic work-up was performed in the emergency room. This seems unlikely however, in that BNP levels are thought to increase within a very short time period of the development of clinically significant pulmonary edema.

## Discussion of Patients

These six patients all experienced symptoms consistent with SIPE at various points or timeframes during the same surface bay swim. These swims were performed in the lateral decubitus position. Water conditions were reported as “cold and rough.”

These patients share several similarities in presentation and symptoms, physical examination findings, and laboratory abnormalities. All six patients presented with various symptoms of shortness of breath, cough, chest pain/tightness, and hemoptysis. Several of the patients were noted to be hypoxemic by pulse oximetry in the field. This hypoxia is common in SIPE, as noted in two of three patients reported on by Lund et al. and as noted by Adir et al.<sup>16,31</sup> Additionally, mild hypothermia was commonly noted.

Several of the individuals' laboratory studies exhibit a mild anemia. This slight anemia is common in BUD/S trainees. One of the three SIPE patients reported on by Lund et al., exhibited this phenomenon.<sup>16</sup> BUD/S trainees admitted to NMCSO for other diagnoses such as cellulitis and pneumonia, frequently demonstrate a mild anemia. Though not specifically addressed in the literature, this common finding in BUD/S trainees is likely due to the extreme daily physical stress of this course of instruction. The anemia is not likely related to the development of SIPE.

## CONCLUSION

Swimming induced pulmonary edema is of clinical significance, particularly in the military, and most notably in Special Operations trainees and recruits. It is a clinical entity noteworthy for its rapid onset, rapid recovery, and return to full duty. The rapid diagnosis of this condition by medical personnel covering strenuous surface swims in the Naval Special Warfare community is critical to avoid serious morbidity and mortality. BNP levels are not elevated in swimming induced pulmonary edema, rendering this laboratory test of little value in the clinical evaluation of pulmonary edema associated with swimming. Further study of the pathophysiology, etiology, and treatment of swimming induced pulmonary edema is required.

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# ABSTRACTS FROM CURRENT LITERATURE

## **Mass Casualty in an Isolated Environment: Medical Response to a Submarine Collision**

CDR Christopher John Jankosky, MC USN  
*Military Medicine* Vol 173, No 8 August 2008

### **EXCERPT**

On January 8, 2005, the *U.S.S. SAN FRANCISCO* (SSN 711), a nuclear-powered submarine, collided with a seamount in a remote Pacific Ocean location. The high-speed impact resulted in injuries to 90% of the crew. Subsequent emergency medical response is described as well as the 3-month physical and psychological morbidity. Recommendations for medical training, equipment, and policy for workers in isolated environments are discussed.

## **Terror-Inflicted Thermal Injury: A Retrospective Analysis of Burns in the Israeli-Palestinian Conflict Between the Years 1997 and 2003**

Haik, Josef MD; Tessone, Ariel MD; Givon, Adi BA; Liran, Alon MD; Winkler, Eyal MD; Mendes, David MD; Goldan, Oren MD; Bar-Meir, Eran MD; Regev, Eli MD; Orenstein, Arie MD; Peleg, Kobi PhD, MPH  
*Journal of Trauma-Injury Infection & Critical Care*. 61(6):1501-1505, December 2006.

### **ABSTRACT**

**Background:** Terror attacks have changed in the past decade, with a growing tendency toward explosives and suicide bombings, which led to a rise in the incidence of thermal injuries among victims. The Israeli-Palestinian conflict of October 2000 marked a turning point when an organized terror campaign commenced. This article presents data of terror-associated burns from the Israeli National Trauma Registry (ITR) during the years 1997 to September 2000 and October 2000 to 2003. **Methods:** We analyzed demographic and clinical characteristics of 219 terror-related burn patients and 6,546 other burn patients admitted to hospitals in Israel between 1997 and 2003. Data were obtained from the ITR. **Results:** Burns contributed about 9% of all terror related trauma and about 5% of all other trauma ( $p < 0.0001$ ). These percentages have not changed significantly before and after October 2000. Terror-related burns afflict Jewish males more than predicted by their percentage in the population, whereas other burns afflict non-Jewish males more than predicted. Adults and young adults (15-59 years) are the predominant group in terror-related burns (80%), whereas children younger than 15 years are the predominant group in other burns (50%). Large burns (20% to 89% total body surface area) are more common in terror casualties, with greater mortality (6.4% in terror-related versus 3.4% in others;  $p = 0.0258$ ). **Conclusion:** Although the incidence of burns has risen because of an organized campaign, this change was noticeable in other trauma forms as well in similar proportions. Terror-related burns afflict a targeted population, and generally take on a more severe course with greater mortality rates, thus requiring appropriate medical treatment.



## Longer-Term Career Outcomes of Uniformed Services University of the Health Sciences Medical School Graduates: Classes of 1980-1989

COL Daniel L. Cohen, USAF MC (Ret.); Steven J. Durning, MD; David Cruess, PhD; COL Richard MacDonald, MC USA (Ret.)

*Military Medicine* May 2008, Vol 173, No 5

### ABSTRACT

**Background:** The Uniformed Services University of the Health Sciences (USUHS) F. Edward Hébert School of Medicine exists to provide physicians who will become leaders in military medicine in both war and peacetime. Studying the career accomplishments of graduates who have reached or are near the end of their military career is one way to assess how well USUHS is meeting this societal charge. **Methods:** Self-reported survey of all 2,689 USUHS graduates since its inception in 1976. Data were collected with regard to residency completed, additional degrees obtained, leadership positions and rank obtained, deployment experience, and academic affiliations. **Results:** Our survey resulted in a 59% response rate (712 of 1,199 respondents) for the matriculating classes of 1980-1989 and a 68% (1,822 of 2,689 respondents) total response rate for all graduates. Career outcome data were analyzed for graduates of the 1980-1989 classes in this article. For this cohort, the board certification rate was 99%; 20% obtained additional degrees; 96% have worked as full-time clinicians; 14% received below-the-zone promotions; 51% had deployed for combat and 42% for humanitarian missions; and 57% continue to hold medical school faculty appointments. **Discussion:** Many accomplishments, to include high sustained board certification rates from a diverse array of specialties, broad deployment experience, achievement of high leadership responsibilities and senior rank, as well as important contributions to academic medicine were achieved by these graduates. Our results support that USUHS is accomplishing its societal charge.

## Air Medical Evacuations of Soldiers Due to Oral-Facial Disease and Injuries, Operations Enduring Freedom/Iraqi Freedom

LTC Timothy A. Mitchener, DC USA; Keith G. Hauret, MPT; Edward L. Hoedebecke, DVM; Salima Darakjy, MPH; Bruce H. Jones, MD

*Military Medicine*, Volume 174, Number 4, April 2009, pp. 376-381(6)

### ABSTRACT

This retrospective study was conducted to assess the nature and causes of serious oral-facial illnesses and injuries among U.S. Army personnel deployed to Iraq and Afghanistan in 2003 and 2004. Information for this study came from the U.S. Air Force Transportation Regulating and Command & Control Evacuation System database for medical evacuations (MEDEVACS) for 2003 to 2004. The study found 327 oral-facial MEDEVACS out of Iraq (cumulative incidence: 11/10,000 Soldiers per year) and 47 out of Afghanistan (cumulative incidence: 21/10,000 Soldiers per year), for a total of 374 MEDEVACS. Forty-two percent (n = 158) of all oral-facial MEDEVACS were due to diseases of the oral cavity, salivary glands, and jaw. Another 36% (n = 136) of oral-facial MEDEVACS were for battle injuries, primarily fractures of the mandible, caused by acts of war. Twenty-one percent (n = 80) of oral-facial MEDEVACS were due to nonbattle injuries, primarily fractures of the mandible, mainly caused by motor vehicle accidents and fighting.

## Prehospital Tourniquet Use in Operation Iraqi Freedom: Effect on Hemorrhage Control and Outcomes

Beekley, Alec C. MD, FACS; Sebesta, James A. MD; Blackbourne, Lorne H. MD; Herbert, Garth S. MD; Kauvar, David S. MD; Baer, David G. PhD; Walters, Thomas J. PhD; Mullenix, Philip S. MD; Holcomb, John B. MC; Members of the 31st Combat Support Hospital Research Group

*Journal of Trauma-Injury Infection & Critical Care*. Advances in Combat Casualty Care: Clinical Outcomes from the War. 64(2) Supplement:S28-S37, February 2008.

### ABSTRACT

**Background:** Up to 9% of casualties killed in action during the Vietnam War died from exsanguination from extremity injuries. Retrospective reviews of prehospital tourniquet use in World War II and by the Israeli Defense Forces revealed improvements in extremity hemorrhage control and very few adverse limb outcomes when

tourniquet times are less than 6 hours. **Hypothesis:** We hypothesized that prehospital tourniquet use decreased hemorrhage from extremity injuries and saved lives, and was not associated with a substantial increase in adverse limb outcomes. **Methods:** This was an institutional review board-approved, retrospective review of the 31st combat support hospital for 1 year during Operation Iraqi Freedom. Inclusion criteria were any patient with a traumatic amputation, major extremity vascular injury, or documented prehospital tourniquet. **Results:** Among 3,444 total admissions, 165 patients met inclusion criteria. Sixty-seven patients had prehospital tourniquets (TK); 98 patients had severe extremity injuries but no prehospital tourniquet (No TK). Extremity Acute Injury Scores were the same (3.5 TK vs. 3.4 No TK) in both groups. Differences ( $p < 0.05$ ) were noted in the numbers of patients with arm injuries (16.2% TK vs. 30.6% No TK), injuries requiring vascular reconstruction (29.9% TK vs. 52.5% No TK), traumatic amputations (41.8% TK vs. 26.3% No TK), and in those patients with adequate bleeding control on arrival (83% TK vs. 60% No TK). Secondary amputation rates (4 (6.0%) TK vs. 9 (9.1%) No TK); and mortality (3 (4.4%) TK vs. 4 (4.1%) No TK) did not differ. Tourniquet use was not deemed responsible for subsequent amputation in severely mangled extremities. Analysis revealed that four of seven deaths were potentially preventable with functional prehospital tourniquet placement. **Conclusions:** Prehospital tourniquet use was associated with improved hemorrhage control, particularly in the worse injured (Injury Severity Score  $>15$ ) subset of patients. Fifty-seven percent of the deaths might have been prevented by earlier tourniquet use. There were no early adverse outcomes related to tourniquet use.

## Effect of Plasma and Red Blood Cell Transfusions on Survival in Patients With Combat Related Traumatic Injuries

Spinella, Philip C. MD; Perkins, Jeremy G. MD; Grathwohl, Kurt W. MD; Beekley, Alec C. MD; Niles, Sarah E. MD, MPH; McLaughlin, Daniel F. MD; Wade, Charles E. PhD; Holcomb, John B. MC

*Journal of Trauma-Injury Infection & Critical Care.* Advances in Combat Casualty Care: Clinical Outcomes from the War. 64(2) Supplement:S69-S78, February 2008.

### ABSTRACT

**Background:** The amount and age of stored red blood cells (RBCs) are independent predictors of multiorgan failure and death in transfused critically ill patients. The independent effect of plasma transfusion on survival has not been evaluated. Our objective was to determine the independent effects of plasma and RBC transfusion on survival for patients with combat-related traumatic injuries receiving any blood products. **Methods:** We performed a retrospective review of 708 patients transfused at least one unit of a blood product at one combat support hospital between November 2003 and December 2004. Admission vital signs, laboratory values, amount of blood products transfused in a 24-hour period, and Injury Severity Score (ISS) were analyzed by multivariate logistic regression to determine independent associations with in-hospital mortality. **Results:** Seven hundred and eight of 3,287 (22%) patients admitted for traumatic injuries were transfused a blood product. Median ISS was 14 (range, 9-25). In-hospital mortality was 12%. Survival was associated with admission Glasgow Coma Scale score, SBP, temperature, hematocrit, base deficit, INR, amount of RBCs transfused, and massive transfusion. Each transfused FFP unit was independently associated with increased survival (OR: 1.17; 95% CI: [1.06-1.29];  $p = 0.002$ ); each transfused RBC unit was independently associated with decreased survival (OR: 0.86; [0.8-0.92];  $p = 0.001$ ). A subset analysis of patients ( $n = 567$ ) without massive transfusion (1-9 RBC/FWB units) also revealed an independent association between each FFP unit and improved survival (OR: 1.22; 95% CI: [1.0-1.48];  $p = 0.05$ ) and between each RBC unit and decreased survival (OR: 0.77; [0.64-0.92];  $p = 0.004$ ). **Conclusion:** For trauma patients transfused at least one unit of a blood product, FFP and RBC amounts were independently associated with increased survival and decreased survival, respectively. Prospective studies are needed to determine whether the early and increased use of plasma and decreased use of RBCs affect mortality for patients with traumatic injuries requiring transfusion.

## The Emerging Role of Preventive Medicine in Health Diplomacy after the 2005 Earthquake in Pakistan

Mancuso, James D.; Price, E. Owen; West, David F.

*Military Medicine*, Volume 173, Number 2, February 2008, pp. 113-118(6)

### ABSTRACT

On October 22, 2005, a preventive medicine team deployed with the 212th Mobile Army Surgical Hospital to assist with earthquake relief efforts in Pakistani-controlled Kashmir. These efforts included core field preventive medicine but quickly extended into other efforts. In collaboration with the host nation and other organizations, the preventive medicine team performed additional support for operations outside the U.S. compound, including water and sanitation assessments of camps for internally displaced persons, communicable disease investigation and control, and vaccination programs. Preventive medicine personnel were vital to health diplomacy efforts in this operation, particularly because of security concerns that prevented other U.S. medical assets from leaving the compound. Comparisons with the U.S. responses during other humanitarian operations are made. Preventive medicine missions in health diplomacy will continue to increase. Training and collaborative relationships with other government agencies, such as the U.S. Agency for International Development, and with nongovernmental organizations should continue to be developed.

## Impact of Prolonged Exercise in the Heat and Carbohydrate Supplementation on Performance of a Virtual Environment Task

Bailey, Stephen P.; Holt, Craig; Pfluger, Kent C.; La Budde, Zina; Afergan, Daniel; Stripling, Roy; Miller, Paul C.; Hall, Eric E.

*Military Medicine*, Volume 173, Number 2, February 2008, pp. 187-192(6)

### ABSTRACT

**Purpose:** The purpose of this investigation was to determine whether performance of a virtual environment (VE) task is influenced by exercise in the heat and carbohydrate supplementation. **Methods:** Ten males completed four exercise trials to fatigue. During each trial, subjects cycled at a submaximal workload. Subjects exercised in a normal environment (NORM) and in a hot environment on different occasions. During exercise, subjects drank  $10 \text{ mL} \times \text{kg}^{-1} \times \text{hour}^{-1}$  of body weight of a 6% carbohydrate beverage (CHO) or a placebo. Subjects completed a VE task before, during exercise, and after fatigue. **Results:** More failures occurred during placebo than CHO during exercise. The NORM CHO trial had the fewest failures at fatigue. More kills occurred during exercise in the NORM CHO. **Conclusions:** Performance of a VE task was negatively influenced by prolonged exercise and heat stress. CHO supplementation may have a positive impact on performance of the VE task following prolonged exercise.

## Emergency Medicine in Lebanon: Overview and Prospect

Jamil D. Bayram MD, MPH

*The Journal of Emergency Medicine* Volume 32, Issue 2, February 2007, Pages 217-222

### ABSTRACT

Emergency Medicine, established in the United States as a specialty in 1979 and in Canada in 1980, is drawing interest among countries throughout Europe, Asia, and the Middle East. Lebanon, located on the eastern coast of the Mediterranean Sea, like many other developing countries, struggles to advance its medical system. One of the main hurdles is the continuing violence and political turmoil. Attempts at health care system recovery have been met with a number of deep-seated structural problems. Data and references regarding emergency healthcare are rare. This article presents an overview of the current status of emergency medicine in Lebanon as well as ongoing related activities over the past decade and the plans for future development.

Parts of this article have been presented by the author at the Second Mediterranean Emergency Medicine Congress in Sitges, Spain, September 16, 2003. This article is the result of an extensive literature search on health and emergency medicine in Lebanon. It presents an expanded analysis with a comprehensive bibliography. The author is emergency medicine trained at Stroger Hospital of Cook County (Chicago) and has had three years experience in Southern Lebanon as a Chairman of the emergency department at Hammoud Hospi-



tal from July 1999 to June 2002. International Emergency Medicine is coordinated by Jeffrey Arnold, MD, of Tufts University School of Medicine and Baystate Medical Center, Springfield, Massachusetts.

## Recombinant Activated Coagulation Factor VII and Bleeding Trauma Patients

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*Journal of Trauma-Injury Infection & Critical Care.* 61(6):1419-1425, December 2006.

### ABSTRACT

**Background:** Recombinant activated coagulation factor VII (rFVIIa) is increasingly being administered to massively bleeding trauma patients. rFVIIa has been shown to correct coagulopathy and to decrease transfusion requirements. However, there is no conclusive evidence to suggest that rFVIIa improves the survival of these patients. The purpose of this study was to determine whether or not rFVIIa has an effect on the in-hospital survival of massively bleeding trauma patients. **Methods:** A retrospective cohort study was conducted from January 1, 2000 to January 31, 2005, at a Level I trauma center in Toronto, Canada. Inclusion criteria included trauma patients requiring transfusion of 8 or more units of packed red cells within the first 12 hours of admission. The primary exposure of interest was the administration of rFVIIa. Primary outcome was a 24-hour survival and secondary outcome was overall in-hospital survival. **Results:** There were 242 trauma patients identified who met inclusion criteria; 38 received rFVIIa. rFVIIa patients were younger, had more penetrating injuries, and fewer head injuries. However, rFVIIa patients required more red cell transfusions initially, and were more acidotic. Administering rFVIIa was associated with improved 24-hour survival, after adjusting for baseline demographics and injury factors. The odds ratio (OR) for survival was 3.4 (1.2-9.8). Furthermore, there was a strong trend toward increased overall in-hospital survival. The OR of in-hospital survival was 2.5 (0.8-7.6). Also, subgroup analysis of rFVIIa patients showed that 24-hour survivors required a slower initial rate of red cell transfusion (4.5 vs. 2.9 units/hr,  $p = 0.002$ ), had higher platelet counts (175 vs. 121 [ $\times 10^9/L$ ],  $p = 0.05$ ) and smaller base deficits (7.1 vs. 14.3,  $p = 0.001$ ) compared with rFVIIa patients who died during the first 24 hours. **Conclusion:** rFVIIa may be able to improve the early survival of massively bleeding trauma patients. However, surgical control of massive hemorrhage still has primacy, as rFVIIa did not appear efficacious if extremely high red cell transfusion rates were required. Also, correction of acidosis and thrombocytopenia may be important for rFVIIa efficacy. Prospective studies are required.

## Resolution and Severity in Decompression Illness

Vann, Richard D.; Denoble, Petar J.; Howle, Laurens E.; Weber, Paul W.; Freiburger, John J.; Pieper, Carl F. *Aviation, Space, and Environmental Medicine*, Volume 80, Number 5, May 2009, pp. 466-471(6)

### ABSTRACT

We review the terminology of decompression illness (DCI), investigations of residual symptoms of decompression sickness (DCS), and application of survival analysis for investigating DCI severity and resolution. The Type 1 and Type 2 DCS classifications were introduced in 1960 for compressed air workers and adapted for diving and altitude exposure with modifications based on clinical judgment concerning severity and therapy. In practice, these proved ambiguous, leading to recommendations that manifestations, not cases, be classified. A subsequent approach assigned individual scores to manifestations and correlated total case scores with the presence of residual symptoms after therapy. The next step used logistic regression to find the statistical association of manifestations to residual symptoms at a single point in time. Survival analysis, a common statistical method in clinical trials and longitudinal epidemiological studies, is a logical extension of logistic regression. The method applies to a continuum of resolution times, allows for time varying information, can manage cases lost to follow-up (censored), and has potential for investigating questions such as optimal therapy and DCI severity. There are operational implications as well. Appropriate definitions of mild and serious manifestations are essential for computing probabilistic decompression procedures where severity determines the DCS probability that is acceptable. Application of survival analysis to DCI data would require more specific case information than is commonly recorded.

## Arterial Compliance in Divers Exposed to Repeated Hyperoxia Using Rebreather Equipment

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*Aviation, Space, and Environmental Medicine*, Volume 80, Number 5, May 2009 , pp. 482-484(3)

### ABSTRACT

**Background:** Acute hyperoxic exposure is known to modify cardiovascular parameters like a decrease in cardiac output, arterial vasoconstriction, and autonomic nervous system changes. We hypothesized that repeated hyperbaric hyperoxic exposures, as experienced by military oxygen divers, lead to long-term arterial alterations. **Methods:** Arterial blood pressure measurements and pulse wave velocity (PWV) recordings were performed during basal conditions in 15 elite military oxygen divers, and compared to 15 non-diver controls. The two groups were matched appropriately for physical characteristics (age:  $35 \pm 5$  yr, weight:  $77 \pm 8$  kg, height:  $177 \pm 6$  cm, body mass index:  $24.6 \pm 2.0$  kg  $\cdot$  m $^{-2}$ ), and aerobic capacity ( $52 \pm 7$  ml  $\cdot$  min $^{-1}$   $\cdot$  kg $^{-1}$ ). **Results:** No significant difference was found in systolic blood pressure ( $120 \pm 11$  mmHg), diastolic blood pressure ( $70 \pm 8$  mmHg), or pulse pressure ( $50 \pm 7$  mmHg). Furthermore, there was no significant difference in the carotid-femoral PWV ( $6.7 \pm 0.9$  m  $\cdot$  s $^{-1}$ ), the carotid-radial PWV ( $8.7 \pm 1.7$  m  $\cdot$  s $^{-1}$ ), or the carotid-pedal PWV ( $8.1 \pm 1.1$  m  $\cdot$  s $^{-1}$ ) between divers and controls. **Conclusion:** No difference in arterial compliance was observed in physically well-trained military oxygen divers in comparison with matched controls.

## Suicide among Discharged Psychiatric Inpatients in the Department of Veterans Affairs

Rani A. Desai, PhD; David Dausey, PhD; Robert A. Rosenheck, MD

*Military Medicine* Vol 173, No 8 August 2008

### ABSTRACT

**Objective:** The objective of this study was to explore correlates of the use of firearms to commit suicide. **Methods:** A national sample of psychiatric patients discharged from Department of Veterans Affairs medical centers was followed from the time of discharge until December 1999. The study explores state-level measures as correlates of overall suicide and suicide by firearm, controlling for individual sociodemographic characteristics and psychiatric diagnosis. The outcomes of interest were completed suicide and suicide by firearm. **Results:** Patients who were male, Caucasian, and who had a diagnosis of substance abuse or post-traumatic stress disorder were significantly more likely to use a firearm than another means to commit suicide. Multivariable models indicated that Veterans living in states with lower rates of gun ownership, more restrictive gun laws, and higher social capital were less likely to commit suicide with a firearm. **Conclusions:** Gun ownership rates, legislation, and levels of community cohesiveness are significantly associated with the likelihood of psychiatric patients committing suicide with a gun.

## **Operation Sadbhavana: Winning Hearts and Minds in the Ladakh Himalayan Region**

LT COL Mudera P. Cariappa, Indian Army Medical Corps; Col Eugene V. Bonventre, USAF MC; MAJ GEN Bikash K. Mohanti, AVSM (Ret.)

*Military Medicine* Vol 173, No 8 August 2008

### **ABSTRACT**

“Sadbhavana” literally means “goodwill among people.” The Indian Army has evolved a military strategy of winning hearts and minds, with this being just a phase in the broader war on terror. We have focused on actions to address the border regions of Ladakh in the Himalayas. The government of India strives against difficult conditions to provide essential services (including health care) to its population in an equitable manner; in remote areas with fragile security and hamstrung provincial government systems, the Indian Army fills this role. The Army’s medical units have played a pivotal role in providing comprehensive health care as a keystone of the strategy. The endeavors of the doctors in uniform have succeeded in winning over an alienated population. A total of 163 medical camps were held in 2004, with attendance of 14,050 patients seeking medical attention and 264 patients seeking dental attention; in 2005, 87 camps were conducted, with attendance totals of 7,562 and 559, respectively. The Operation Sadbhavana military strategy has paid rich dividends in the form of changes in the perspective of the denizens of the remote and exotic locales of Ladakh. Planners must carefully analyze the target audiences and the messages delivered to those audiences at the onset of such projects. Future efforts would be enhanced by attempts to quantify the effects of medical missions on the health of the population and on population attitudes toward the Indian Army and the central government.

## **The Challenge of Controlling Lead and Silica Exposures from Firing Ranges in a Special Operations Force**

Mancuso, James D.; McCoy, John; Pelka, Bruce; Kahn, Patrice J.; Gaydos, Joel C.

*Military Medicine*, Volume 173, Number 2, February 2008, pp. 182-186(5)

### **ABSTRACT**

In 2000, Soldiers from a Special Operations Force had airborne lead exposures 20 to 38 times the permissible exposure limit. Their average blood lead level was 13.9 µg/dL. Immediate implementation of pertinent Occupational Safety and Health Administration regulations was recommended. In 2003, investigators learned that the unit also used an outdoor firing range with exposures exceeding the permissible exposure limit. Attempts to conduct more detailed evaluations and control measures were hindered by frequent deployments in the unit and a strong commitment to realistic training. Despite these challenges, the controls implemented resulted in limited success. The average blood lead level in the unit was 6.8 µg/dL in 2005, a reduction of 51%. Proper initial range construction is essential to controlling lead exposures at firing ranges. Occupational health specialists caring for these Soldiers must identify, assess, and mitigate exposures from firing ranges while respecting the importance of realistic training.

## **The Overlooked Heroines: Three Silver Star Nurses of World War I**

LTC Richard M. Prior, AN USA; William Sanders Marble, PhD

*Military Medicine* May 2008, Vol 173, No 5

### **ABSTRACT**

As members of forward-deployed combat hospitals, World War I Army nurses Miss Jane Rignel, Miss Linnie Leckrone, and Miss Irene Robar received the Citation Star for gallantry in attending to the wounded while under artillery fire in the month of July 1918. In 1932, they were authorized to exchange their Citation Stars for the new Silver Star Medal. Nursing in the war was difficult and required caring for patients exposed to chemical weapons and trauma while in harsh field conditions. These women were among the many Army nurses decorated for their performance in World War I.



## Loss of Consciousness and Seizure During Normobaric Hypoxia Training

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Aviation, Space, and Environmental Medicine, Volume 80, Number 5, May 2009 , pp. 485-488(4)

### ABSTRACT

Loss of consciousness is a symptom with a broad differential diagnosis. Distinguishing between syncope and seizure in a patient with a history of loss of consciousness can be equally difficult as their presentation can be very similar. We present the case of a naval electronic countermeasures officer who experienced a loss of consciousness while undergoing hypoxia training with the reduced oxygen breathing device (ROBD). During the episode the patient experienced tonic-clonic contractions with subsequent vertebral fractures, resulting in a prolonged grounding period. The patient's work-up focused on ruling out inherent cardiac and neurologic etiologies. After extensive examination and consultation with neurology, the patient was diagnosed with hypoxia-induced seizure, but was not felt to have an underlying seizure disorder. After reviewing his case, the Naval Aerospace Medical Institute felt that this incident represented a physiologic event and not a medical condition inherent to the aviator. It was, therefore, determined that this episode was not considered disqualifying and did not require a waiver for return to duties involving flight. Our discussion details the appropriate work-up for loss of consciousness, examines possible physiologic explanations for this event, and describes aeromedical considerations. The authors include the patient's physiology instructor, one of the primary witnesses for the event, and the patient's flight surgeon, who was extensively involved in his care.

## Ventilated Vest and Tolerance for Intermittent Exercise in Hot, Dry Conditions With Military Clothing

Barwood, Martin J.; Newton, Phillip S.; Tipton, Michael J.

Aviation, Space, and Environmental Medicine, Volume 80, Number 4, April 2009 , pp. 353-359(7)

### ABSTRACT

**Introduction:** Recent research has focused on developing air-ventilated garments to improve evaporative cooling in military settings. This study assessed a ventilated vest (Vest) in hot (45°C), dry (10% RH) ambient conditions over 6h of rest and exercise. It was hypothesized that the Vest would lower the thermal strain and increase the amount of exercise done by subjects. **Methods:** Eight healthy heat-acclimated men, wearing combat clothing, body armor, and a 19-kg load in webbing walked on a treadmill at 5 km • h<sup>-1</sup> at a 2% incline until rectal temperature (T<sub>rec</sub>) reached 38.5°C. They then rested until T<sub>rec</sub> reached 38°C, at which point they recommenced walking. On one occasion the subjects wore a Vest, blowing ambient air around the torso. On the second occasion subjects did not wear the vest (NoVest). Exercise/rest ratio, T<sub>rec</sub>, skin temperature (T<sub>sk</sub>), sweat responses, rating of perceived exertion (RPE), and thermal comfort (TC) were measured. **Results:** Subjects wearing the Vest exercised for significantly longer (18%; 11 min/h) as a percentage of total exposure time, stopped exercise significantly less often [Mean (SD); NoVest: 3 (2) stops; Vest: 1 (2) stops], and maintained significantly lower skin temperature under the body armor [T<sub>chest</sub>: NoVest 37.55 (0.51)°C; Vest: 35.33 (1.00)°C; T<sub>back</sub>: NoVest: 36.85 (0.83)°C; Vest: 35.84 (0.88)°C]. The Vest provided 28 W of cooling during exercise and 73 W when at rest as estimated by thermometry. **Conclusion:** A ventilated vest can provide cooling, and thereby reduce thermal strain and increase exercise done in dry environmental temperatures up to 45°C, without causing skin irritation and discomfort.

## CENTRAL RETINAL VEIN OCCLUSION IN AN ARMY RANGER WITH GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY

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### ABSTRACT

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is the most prevalent human enzyme deficiency, affecting an estimated 400 million people worldwide. G6PD deficiency increases erythrocyte vulnerability to oxidative stress and may precipitate episodes of hemolysis when individuals are exposed to triggering agents. Although central retinal vein occlusion (CRVO) does occur in G6PD-deficient individuals, G6PD-deficient individuals exposed to oxidative stressors have not been previously reported to have an increase in CRVO incidence. This is a case of an Army Ranger who deployed to Afghanistan with unrecognized G6PD deficiency and was placed on primaquine following his return to the United States and subsequently developed CRVO. Primaquine is a well-recognized cause of hemolysis in individuals with G6PD deficiency. Hemolytic anemia may contribute to thrombosis as a result of increased erythrocyte aggregation and erythrocyte-endothelium interaction. This case underscores the continued need for routine G6PD screening and avoidance of known triggers in G6PD-deficient individuals.

### INTRODUCTION

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is the most common human enzyme disorder in the world, with over 440 genetic variants and more than 400 million people affected worldwide.<sup>1,2,3</sup> G6PD-deficient individuals can develop acute hemolytic anemia and other associated reactions when exposed to oxidative stressors including infections, toxins, foodstuffs, and medications. According to existing literature regarding the occurrence of retinal vein occlusions in this population, G6PD-deficient individuals are postulated to have a significantly lower risk of developing central retinal vein occlusion (CRVO).<sup>4</sup> However, the literature does not state the risk of CRVO development in a G6PD-deficient individual with an on-going oxidative stressor. Retinal vein occlusion, which includes branch retinal vein occlusion and CRVO, is the second most common sight-threatening retinal vascular disorder worldwide following diabetic retinopathy.<sup>5</sup> This case presents a patient with unrecognized G6PD deficiency who was placed on primaquine for malaria prophylaxis and subsequently developed a CRVO.

### CASE REPORT

A 35-year-old active duty Army Ranger of Mediterranean descent presented to his primary care provider with the chief complaint of constant blurred vision in his right eye with associated symptoms of photophobia and a “seasick” sensation upon awakening one morning. These symptoms continued to progressively worsen up until the time of his presentation two weeks later. He denied ocular pain or any other symptoms at the time of his initial evaluation.

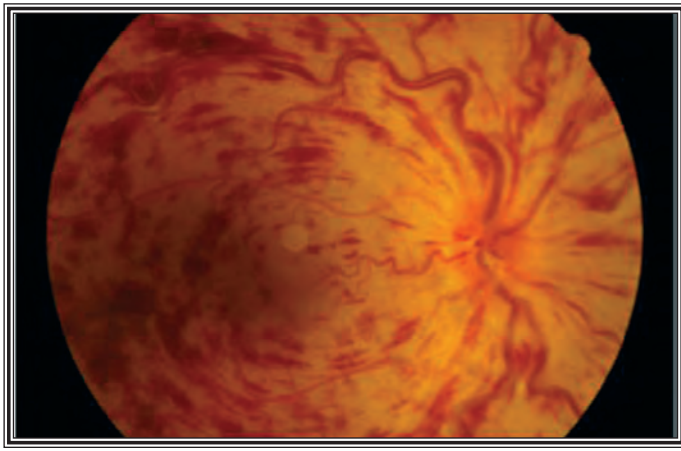
The patient’s past medical history was unremarkable except for intermittent mild normocytic normochromic ane-

mia of unknown origin initially noted on a routine physical examination five years earlier. The patient denied any history of visual complaints, treatment for ophthalmologic conditions, tobacco use, drug allergies, and prior medication complications.

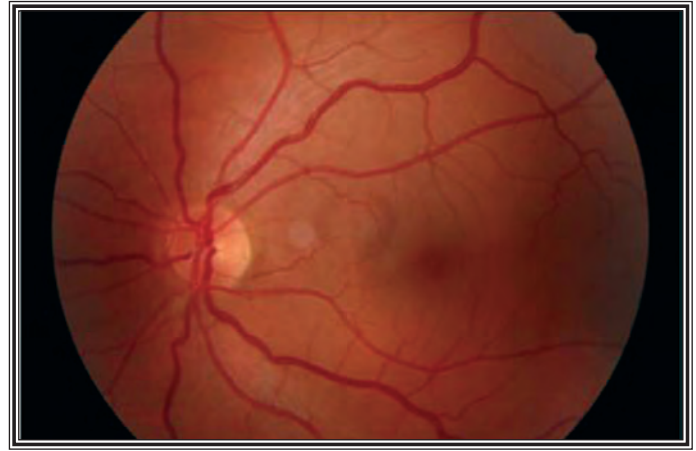
The patient’s recent medication history consisted of doxycycline 100mg daily for malaria chemoprophylaxis, which he consumed before, during, and after a three month deployment to Afghanistan. He also consumed a two-week course of primaquine base 15mg daily concomitantly during the last two weeks of his doxycycline regimen. Both medications were completed the month prior to symptom onset. The patient stated that he was compliant with the medication regimens.

The physical examination at the time of presentation revealed a distance visual acuity without correction of 20/200 OD and 20/20 OS. His medical record denoted that he had previously maintained a visual acuity of 20/20 bilaterally without correction. The remainder of his physical exam was unremarkable to include stable vital signs with a normal blood pressure. He was referred to an ophthalmologist who confirmed the decreased vision in the right eye and also noted an afferent pupillary defect, or Marcus Gunn reaction, of the right pupil. Additionally, the right eye fundoscopic examination was remarkable for dilated, tortuous veins, diffuse four-quadrant intraretinal hemorrhage, and macular edema. (Figure) The remainder of the ophthalmologic exam was normal to include noncontact tonometry intraocular pressures of 14mmHg in each eye and an unremarkable slit lamp examination.

The ophthalmologist diagnosed nonischemic CRVO, and the patient was given a two-week course of brimonidine 0.2% one drop twice a day, Cosopt™ (dorzolamide 2% and timolol 0.5%) one drop twice a day, latanoprost 0.005% one drop



OD – Central Retinal Vein Occlusion



OS – Normal

**Figure.** Bilateral fundoscopic evaluation of patient's eyes. OS is normal and OD is remarkable for dilated tortuous veins, diffuse intraretinal hemorrhage, and macular edema ("blood and thunder" fundus), which is characteristic of central retinal vein occlusion.

at bedtime, and acetazolamide 500mg one capsule daily. The patient was also started on aspirin 325mg one tablet daily, which he continued throughout the year.

The ophthalmologist conducted an initial laboratory workup which included a complete blood count, fasting glucose, prothrombin time/partial thromboplastin time, protein C antigen, protein S activity, homocysteine, antithrombin III antigen, anticardiolipin panel, antinuclear antibody screen, rapid plasma reagin, and *Treponema pallidum* antibody. All of these lab results were noted to be within normal limits. Also conducted was a bilateral carotid ultrasound that depicted no significant stenosis or atherosclerotic plaques.

The ophthalmologist referred the patient to a retinal specialist and an internist. The retinal specialist provided regular monitoring and administered a series of intravitreal triamcinolone injections throughout the following year to reduce the macular edema present. The internal medicine physician reviewed the previous labs and ordered additional laboratory testing to include a urinalysis, complete blood count, comprehensive metabolic panel, prothrombin time/partial thromboplastin time, antinuclear antibody screen, antithrombin III antigen, factor V Leiden DNA, factor VIIIa, von Willebrand factor, factor XIIa, protein C antigen, complement protein C3 and C4, complement CH50, lupus anticoagulant battery, dilute Russell Viper venom time, immunoglobulin antibodies, cryoglobulin screen, and hepatitis B and C panel. All of these lab results were noted to be within normal limits. A computerized tomography (CT) scan of the chest and abdomen depicted minimal pleural-parenchymal densities scattered in the left peripheral lung field with a few tiny calcifications representing residua from a prior inflammatory disease. The patient denied any pulmonary symptoms and no prior CT scans were available for comparison. The internal medicine physician consulted a hematologist who reviewed the lab and CT results and offered no further diagnostic or treatment options beyond those currently being provided by the retinal specialist.

It was not until a year later that a new primary care provider noted that the patient was G6PD-deficient during routine lab screening for G6PD prior to initiating primaquine therapy for a subsequent deployment to Afghanistan. The patient's G6PD value was 0.2 IU/g Hb (reference range for normal 7.0-20.5 IU/g Hb), and he was categorized as having severe enzyme deficiency (< 10% of normal). However, he did not fulfill the full Class II criteria depicted by the World Health Organization as there was no historical evidence of intermittent hemolysis with erythrocytic stress or chronic hemolytic anemia.<sup>2</sup> Following a review of the patient's records, this provider hypothesized a possible connection between the patient's G6PD deficiency, his previous intake of primaquine, and the development of CRVO that ensued following his previous deployment to Afghanistan. This provider conducted a thorough literature search and discussed the case with preventive medicine specialists at the U.S. Army Center for Health Promotion and Preventive Medicine, an infectious disease specialist at Brooke Army Medical Center, and ophthalmology specialists in the Army and Navy. A similar case was not previously cited.

The patient continued routine treatment and follow-up with his ophthalmologist and the retinal specialist. At the two-year follow-up he was noted to have an uncorrected visual acuity of 20/20 OD and OS. There was no afferent pupillary defect and noncontact tonometry intraocular pressures were 15mmHg OD and 12mmHg OS. The slit lamp examination was negative for iris neovascularization OD. The OD fundoscopic exam denoted mild residual disk edema, vascular tortuosity, and macular edema with a few scattered retinal hemorrhages. The fundus was normal OS.

## DISCUSSION

### *G6PD Deficiency*

G6PD is a critical metabolic enzyme that supports reduction and oxidation in aerobic cells such as erythrocytes. The gene for G6PD is sex linked and found on the long arm



of the X chromosome. Notable is that more than 400 million people carry a G6PD-deficient gene.<sup>1,2,3</sup> Although dispersed worldwide, G6PD deficiency occurs with increased frequency throughout Africa, Asia, the Middle East, and the Mediterranean region. While G6PD deficiency may provide a biological advantage through relative resistance to *Plasmodium falciparum* malaria, it has over 440 known genetic variants that result in varying degrees of enzymopathy and a wide spectrum of clinical outcomes ranging from asymptomatic to severe hemolytic reactions resulting in transfusion or death.<sup>1,2</sup> G6PD deficiency has conventionally been the archetype of enzymopathy hemolytic anemias and is a leading model of hemolytic anemia resulting from intracorporeal and extracorporeal interaction, as most of these hemolytic cases are triggered by an exogenous agent. These exogenous triggers include infections, toxins, foodstuffs (ie, fava beans), and medications (ie, antimicrobials).

Although the antimicrobial primaquine prompted the discovery of G6PD deficiency over 50 years ago,<sup>1</sup> primaquine continues to be an important adjunct used routinely for anti-malarial therapy. As a response to frequent deployments of numerous Army personnel to malaria-endemic regions including Afghanistan, the Department of the Army directed that all deploying U.S. Army personnel would undergo G6PD deficiency screening in order to safeguard against hemolytic reactions resulting from primaquine therapy.<sup>6</sup> In this case report, it is uncertain how the individual described did not receive screening for G6PD deficiency prior to the initiation of primaquine therapy.

By itself, primaquine is a cause of increased levels of methemoglobin in many patients who take it, but the levels achieved seldom cause symptoms. However, pathologic methemoglobinemia and hemolytic anemia do routinely occur in G6PD-deficient individuals who consume primaquine. Primaquine is known to be associated with visual accommodation complaints, although a review of the literature does not reveal documentation of other visual disorders to include CRVO. However, the finding of increased erythrocyte aggregation and erythrocyte-endothelium interaction observed in hemolytic disease states may contribute to diffuse microvascular thrombosis in various organ systems to include the eye.<sup>7</sup>

### Central Retinal Vein Occlusion

Retinal vein occlusion includes branch retinal vein occlusion and central retinal vein occlusion. Following diabetic retinopathy, retinal vein occlusion is the second most common sight-threatening retinal vascular disorder. The prevalence of CRVO in the United States has been reported to be 1 per 1000 and is slightly more common in men than in women.<sup>5</sup>

The majority of people diagnosed with CRVO are over the age of 50. The most common symptom of CRVO is acute and persistent monocular visual loss. Patients characteristically present with an abrupt, painless, unilateral loss of vision of variable severity. CRVO is generally categorized as ischemic or nonischemic. The hallmark fundus finding of CRVO is four-quadrant retinal hemorrhage. The more common nonischemic form has good perfusion to the retina and relatively good visual acuity on presentation. Vision may return to normal if not decreased by persistent macular edema.

Nonischemic CRVO can progress to ischemic CRVO, with one-third of nonischemic cases progressing to ischemic within a year. Frequent follow-up is needed to monitor for this change. Patients can also have ischemic CRVO on initial presentation with visual acuity typically 20/400 or worse. Ischemic CRVO typically presents with more extensive retinal hemorrhage, cotton wool spots, disc edema, and often an afferent pupillary defect. Intravenous fluorescein angiogram is commonly used to help define the level of retinal non-perfusion in CRVO. Vision loss in ischemic CRVO may result from ganglion cell ischemia, macular edema, or neovascular complications with secondary glaucoma.

Although CRVO can occur without a known underlying cause, it is often associated with systemic disease (atherosclerosis, autoimmune disease, diabetes, hypertension, intravenous drug abuse, renal insufficiency, tobacco use, vasculitis) or local pathology (ocular trauma, orbital abscess, orbital tumor, glaucoma).<sup>5,8</sup> When CRVO occurs in younger patients it is often associated with blood dyscrasias such as coagulation disorders and hyperviscosity syndromes.

Sickle cell disease has been associated with a hypercoagulable state.<sup>7</sup> Given the hyperviscosity and vaso-occlusive tendencies of individuals with sickle cell crisis,<sup>9</sup> it is interesting that only one case of CRVO in a sickle cell patient has been reported in the literature.<sup>10</sup> Additionally, it is notable that in this sickle cell case report, a comorbid protein S deficiency may have contributed to the ultimate CRVO pathogenesis. Furthermore, an extensive review of the medical literature also detected only one article describing CRVO incidence in G6PD-deficient patients.<sup>4</sup> However, this article postulated protection against CRVO in Sardinian G6PD-deficient patients with the Mediterranean variant. The investigators in this study cited a 3.55% incidence of CRVO in their G6PD-deficient population versus a 10-15% incidence of CRVO in their general population. Not stated in this article was the risk of CRVO development in a G6PD-deficient individual with an active oxidative stressor.

Treatment of CRVO has historically been directed toward the management of the contributing or associated systemic medical problem, as few treatments have had proven efficacy in the treatment of CRVO. Treatment options include aspirin, non-steroidal anti-inflammatory drugs, plasmapheresis, anticoagulation, fibrinolytics, and systemic corticosteroids. Anti-platelet agents are frequently prescribed; however, their efficacy is controversial. Panretinal photocoagulation is used for patients experiencing neovascular complications to reduce or reverse angiogenesis and avoid the development of neovascular glaucoma.

Additional treatment options with improved efficacy have recently become available. Intravitreal triamcinolone has proven effective in reducing edema and improving vision for patients with macular edema,<sup>11,12</sup> and is more likely to be efficacious in patients without ischemic CRVO or diabetes. However, these patients sometimes have rebound symptoms and require continued treatment.

A new approach to treating CRVO is the use of intravitreal bevacizumab.<sup>13</sup> Elevated levels of vascular endothelial growth factor (VEGF) have been found in CRVO and have been positively correlated with the onset and progression

of CRVO neovascular complications.<sup>14</sup> The ability of VEGF blockers to decrease vascular permeability has also suggested its usefulness in treating macular edema. This therapy was successful in improving the vision of one patient with a non-ischemic CRVO from 20/200 to 20/25 eight weeks following injection. Bevacizumab also offers the advantage of not causing increases in intraocular pressure sometimes seen with intravitreal triamcinolone injections.<sup>13</sup>

A new option for treating ischemic CRVO may be hyperbaric oxygen therapy (HBOT).<sup>15</sup> There is a strong theoretical basis for HBOT to be useful in managing ischemic CRVO, and there are multiple case reports documenting success with this treatment modality. As with central retinal artery occlusion, there is likely a time window beyond which HBOT is less likely to be effective, but this time window is not well defined for CRVO.<sup>16,17,18</sup>

## CONCLUSION

G6PD-deficiency is noted to affect 2.5% of military males, with up to 12% of the African American military population.<sup>6</sup> Although uncertain that the CRVO experienced by the individual described in this report was a result of his primaquine therapy, this case still underscores the continued requirement for routine G6PD deficiency screening in deploying military personnel and the avoidance of all potential triggers in patients who are G6PD-deficient. G6PD-deficient individuals may suffer hemolytic reactions and other adverse reactions when exposed to oxidative stressors such as primaquine. In this case report, it may be possible that exposure to primaquine in a patient with unrecognized G6PD deficiency may contribute to the development of CRVO.

## DISCLAIMER

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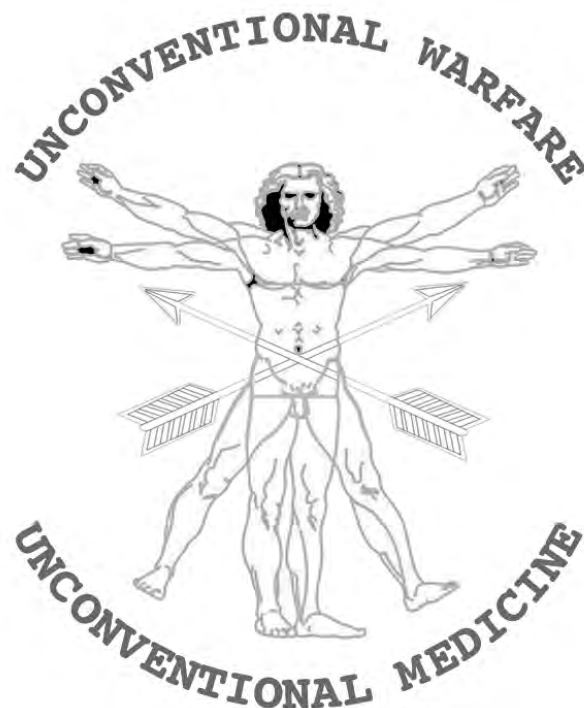
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# SHOULD WE TEACH EVERY SOLDIER HOW TO START AN IV?

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The recent mandate by the U.S. Army Training and Doctrine Command (TRADOC) requiring all soldiers entering basic combat training (BCT) after October 1, 2007 to be combat lifesaver (CLS) certified is an outstanding step to improve training across the Army in lifesaving first-aid skills.<sup>1</sup> However, requiring all Soldiers to be competent in placing an intravenous line and initiating treatment with IV fluids, per the current CLS standards, may not be the best use of precious training resources in light of the most recent medical research and battlefield experience.

The outcome of a battle casualty will often be determined by whomever provides initial care. In most cases this will be a fellow Soldier, not the medic. The CLS course was developed to bridge the gap between self-aid or buddy aid until care could be provided by the platoon 68W combat medic.<sup>2</sup> The CLS concept has been further refined over the last decade to reflect the concepts of TC3. Tactical combat casualty care focuses on treating the leading causes of preventable battlefield death while minimizing the risk to first-aid providers and the tactical mission.<sup>3</sup> The TC3 concept is possibly the most significant advance in point of injury care since the distribution of the individual field dressing in the late 1800s.<sup>4</sup>

The most important battlefield first-aid skill is controlling hemorrhage, by far the leading and most preventable cause of battlefield death in modern warfare. Bellamy showed 9% of those killed in action during the Vietnam conflict died of potentially preventable extremity hemorrhage.<sup>5</sup> A similar fatality rate from compressible extremity hemorrhage in Iraq was demonstrated by Cuadrado et al.<sup>6</sup> Proper tourniquet application is the most important method in controlling severe hemorrhage in the tactical setting.

Other lifesaving skills emphasized in the TC3 include needle decompression of a tension pneumothorax and airway management, the second and third leading causes of preventable battlefield deaths, causing 4% and 1% of all fatal injuries respectively.<sup>5,7</sup>

The main purpose of performing IV catheterization in the setting of trauma is to administer fluids or blood products to treat hemorrhagic shock. Seven percent of patients on the battlefield require aggressive resuscitation.<sup>8</sup> Current transfusion protocols emphasize fresh whole blood and procoagulants rather than crystalloids to restore organ perfusion, prevent the dilution of clotting factors, and avoid hypothermia.<sup>8</sup> For patients in significant hemorrhagic shock, aggressive hemorrhage control at the point of wounding, followed by expeditious transport to surgical care is most important. Evacuation and subsequent surgical management of noncompressible truncal hemorrhage should not be delayed by attempts to place an IV.

In the management of shock, the traditional strategy of early fluid resuscitation beginning in the field and continuing into the operating room has been challenged, specifically in the context of penetrating thoracic trauma. In 1994, a prospective trial by Bickell et al. compared immediate versus delayed fluid resuscitation in hypotensive patients with pene-

trating torso injuries. They reported that patients in whom fluids were restricted until arrival in the operating room had lower mortality, fewer postoperative complications, and shorter hospital length of stay.<sup>9</sup> In a follow-up prospective trial, patients were divided into either restrictive resuscitation (goal systolic blood pressure (SBP) greater than 80mmHg) versus liberal resuscitation (goal SBP greater than 100mmHg). There was not a significant difference in mortality between groups but hemorrhage did take longer to control in the group with the liberal fluid strategy.<sup>10</sup>

These studies were largely responsible for significant changes in the management of injured soldiers on the battlefield and were adopted by American Military and Israeli Defense Forces.<sup>11-15</sup> In 2003, the term “hypotensive resuscitation” was introduced in a article entitled, “Fluid Resuscitation in Modern Combat Casualty Care: Lessons Learned from Somalia.”<sup>15</sup> Current military prehospital doctrine now emphasizes restricting IV fluids in casualties who have controlled hemorrhage, normal mental status, and stable vital signs or even mild hypotension (systolic blood pressure greater than 90). A relatively small percentage of all combat casualties are likely to benefit from IV fluid resuscitation on the battlefield.

These include patients with significant hypotension resulting from severe hemorrhage that has been controlled; and, those with hypotension or severe hemorrhage and a head injury. All other casualties with uncontrolled hemorrhage and signs of shock may be challenged with a very limited amount of IV fluid (1,000mL of Hextend). Further fluid administration is likely to be detrimental. The practice of permissive hypotension is designed to prevent “popping the clot” off an injured vessels as well as diluting clotting factors with massive amounts of crystalloid fluid.

Intravenous placement is a skill that requires significant time to acquire. In the current CLS course, the IV portion is the longest, most resource and instructor intensive block of training. This is precious training time that could be used for tactical casualty scenarios and practicing sustainable, lifesaving skills such as hemorrhage control techniques. In the civilian sector, basic emergency medical technicians (EMT-B) are not taught IV insertion. The first level of civilian EMT to have IV placement in their scope of practice is EMT-Intermediates. The national standard curriculum for EMT-I requires 300-400 hours of classroom and field instruction after EMT -8 certification. EMT-I students are required to place a minimum of 25 IVs on live patients of various age groups under instructor supervision to be considered competent in this skill.<sup>16</sup> The current 2006 CLS Course Instructor Guide (Edition B, Sub course IS00873) does not specify the number of successful IV catheterizations required to certify a CLS in this skill. It is left to the unit’s medical officer. Certification as a CLS will not mean these Soldiers are competent at placing IVs. At best it will mean they are familiar with the procedure.

Casualties presenting in overt shock typically have difficult intravenous access. They are often extremely diaphoretic and their peripheral vasculature is constricted. Placement of an IV in a trauma patient in a moving ambulance by an experienced EMT-I or higher level provider takes 10 to 12 minutes and has a 10% to 40%, failure rate.<sup>17</sup> Paradoxically, starting an IV in those patients who would most benefit from limited fluid resuscitation will be extremely difficult for even the most skilled medical provider. During a hostile tactical situation combined with darkness, fatigue, and fear it will be very unlikely that a Soldier without significant medical experience will be able to place an IV under battlefield conditions. For this reason, TC3 guidelines emphasize sternal intraosseous catheter placement for fluid resuscitation.<sup>18</sup>

Insertion of an IV catheter is not without risks. Complications include local and systemic infections, deep venous thrombosis, thrombophlebitis, catheter embolism, and injury to associated nerves, tendons, and arteries.<sup>19-21</sup> Complications are inversely related to skill and experience of the medical provider.

On the basis of the available literature and the lessons being learned from both Iraq and Afghanistan, it is clear that IV placement is not a critical lifesaving skill, while hemorrhage control is. Training all Soldiers to start IVs without the requisite understanding of the indications, contraindications, risks, and benefits of who would benefit from IV fluids and who could be harmed, could result in many receiving unneeded or detrimental care on the battlefield. If Soldiers spend the vast majority of their first-aid training time learning IV placement, the most time-consuming skill in the CLS course, yet one that does not save lives, which tool will they reach for under the stress of combat? Will Soldiers be killed by snipers as they waste precious minute starting IVs? Will evacuation to life-saving surgical care be delayed while attempts to “get the IV” are made? Will proper tourniquet and dressing application be neglected while focusing on the more “technical” and “high-speed” IV insertion?

While most Soldiers will not benefit from IV training, it may have a place in some units. Units operating far forward with little or no organic medical support such as Special Operations Forces (SOF) may benefit from this training. These units are often small and have the time and resources to train to a high standard in advanced first-aid skills.

Many line commanders likely participated in “IV training” led by their unit medical officers during their formative years. Insertion of an IV on the “first stick” is considered by many as the quintessential battlefield medical skill. It is not. Rapid hemorrhage control is. Additional medical training for all Soldiers is much needed. TRADOC has taken an excellent first step. Our battlefield commanders want robust first-aid training for our warriors. We must continue to synthesize the tactical and medical lessons from the present conflicts to guide our training. It is the duty of the AMEDD and military health-care providers to develop best practices of battlefield care and advise our combat commanders how to implement them so together we can save lives on the battlefield and accomplish the Army mission.

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# PSYCHOLOGICAL RESILIENCE AND POSTDEPLOYMENT SOCIAL SUPPORT PROTECT AGAINST TRAUMATIC STRESS AND DEPRESSIVE SYMPTOMS IN SOLDIERS RETURNING FROM OPERATIONS ENDURING FREEDOM AND IRAQI FREEDOM

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## ABSTRACT

**Background:** A number of studies have examined the prevalence and correlates of posttraumatic stress disorder (PTSD), depression, and related psychiatric conditions in Soldiers returning from Operations Enduring Freedom and Iraqi Freedom (OEF/OIF), but none have examined whether factors such as psychological resilience and social support may protect against these conditions in this population. **Methods:** A total of 272 predominantly older reserve/National Guard OEF/OIF veterans completed a mail survey assessing traumatic stress and depressive symptoms, resilience, and social support. **Results:** Resilience scores in the full sample were comparable to those observed in civilian outpatient primary-care patients. Respondents with PTSD, however, scored significantly lower on this measure and on measures of unit support and postdeployment social support. A hierarchical regression analysis in the full sample suggested that resilience (specifically, increased personal control and positive acceptance of change) and postdeployment social support were negatively associated with traumatic stress and depressive symptoms, even after adjusting for demographic characteristics and combat exposure. **Conclusions:** These results suggest that interventions to bolster psychological resilience and postdeployment social support may help reduce the severity of traumatic stress and depressive symptoms in OEF/OIF veterans.

## INTRODUCTION

A large number of Soldiers serving in Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) are returning from their deployments with posttraumatic stress disorder (PTSD), depression, and related psychological problems that impair functioning and quality of life.<sup>1</sup> Although several studies have examined the prevalence and correlates of these conditions in this population,<sup>2,3</sup> little research has examined factors that may be protective against traumatic stress and depressive symptoms.

Psychological resilience and social support may protect against the development of traumatic stress<sup>4,5</sup> and depressive symptoms.<sup>6</sup> Psychological resilience and related constructs such as hardiness are characteristics that enable an individual to adapt positively to adversity and that confer protection against the development of psychopathology.<sup>5,7</sup> They have been shown to protect against the development of PTSD following combat in Vietnam veterans<sup>4,8</sup> and Army Reserve Soldiers.<sup>9</sup> Higher perceived social support, which is operationalized as an individual's perception or experience of helpful and unhelpful social interactions, is also negatively associated with PTSD<sup>10,11</sup> and depression,<sup>5</sup> with higher perceived social support associated with lower risk of PTSD<sup>4,12,13</sup> and depression.<sup>5</sup> These findings suggest that increased psychological resilience and perceived social support may help protect against the deleterious effects of traumatic stress and depression.

To date, however, no known study has examined variables that may confer protection against traumatic stress and depressive symptoms in OEF/OIF veterans. An examination of differential aspects of resilience and social support is important because it may provide insights into cognitive, behavioral, social, and spiritual factors that may protect military personnel exposed to trauma against the development of

PTSD, depression, and related conditions, and potentially inform training and treatment strategies to enhance resilience to stress. The purpose of this study was to: (1) provide a descriptive analysis of aspects of resilience endorsed by OEF/OIF veterans; (2) compare endorsements of various aspects of resilience between OEF/OIF veterans with and without PTSD; and (3) examine whether resilience and social support may protect against traumatic stress and depressive symptoms after controlling for demographic characteristics and severity of combat exposure. We hypothesized that OEF/OIF veterans would report relatively high levels of resilience in general, that compared to veterans without PTSD, veterans with PTSD would score lower on measures of resilience and social support, and that increased resilience and social support would be negatively associated with severity of traumatic stress and depressive symptoms.

## METHODS

### SAMPLE

Respondents were 272 OEF/OIF veterans from Connecticut who completed the Connecticut OEF/OIF Veterans Needs Assessment Survey (dates of military service: 01/03–03/07). This survey was developed to identify the salient needs of OEF/OIF veterans in Connecticut and provide recommendations for legislative and public policy initiatives to improve readjustment to civilian life. The target population was all Connecticut veterans who served in OEF/OIF since 2003. Potential respondents were identified by the inspection of copies of discharge papers (DD-214s) that were sent to the Commissioner of Veterans Affairs for the state. Her staff identified eligible veterans and selected the first 1,050 (alphabetically) for the target sample. One thousand and fifty surveys were mailed and 285 were returned (27.1% return

rate). A reminder postcard was sent 1 week after the surveys were mailed. Respondents were older than nonrespondents in the sampling frame (33.4 versus 31.3 years,  $t_{52.87}$ ,  $P=0.004$ ). On average, surveys were completed 26.9 months (standard error of the mean [SEM] 5.7) following return from deployment. Institutional review boards of the Yale University, the Central Connecticut State University, and the VA Connecticut Healthcare System approved the study.

## ASSESSMENTS

The *Connor–Davidson Resilience Scale* (CD-RISC<sup>14</sup>) is a 25-item self-report assessment of psychological resilience. Items are scored on a 5-point range: “0” for “Not true at all,” “1” for “Rarely true,” “2” for “Sometimes true,” “3” for “Often true,” and “4” for “True nearly all of the time.” Total scores, which range from 0 to 100, and five subscales, which were generated using exploratory factor analysis in the initial validation study of this instrument,<sup>14</sup> are computed: (1) personal competence, (2) tolerance of negative affect and stress-related growth, (3) acceptance of changes, (4) personal control, and (5) spiritual orientation to the future. In this sample, Cronbach’s  $\alpha$  on CD-RISC items was .94.

The *Combat Experiences Scale* (CES) is a 15-item self-report instrument from the Deployment Risk and Resilience Inventory (DRRI,<sup>15,16</sup> available upon request from: [http://www.ncptsd.va.gov/ncmain/assessment/assessmt\\_request\\_form.html](http://www.ncptsd.va.gov/ncmain/assessment/assessmt_request_form.html)). It assesses exposure to combat, such as firing a weapon, being fired on by enemy or friendly fire, and witnessing injury and death. Higher scores represent greater combat exposure. A previous validation study in OIF veterans found that CES scores correlated positively with measures of PTSD and depression symptoms and negatively with mental health functioning.<sup>16</sup> In this sample, Cronbach’s  $\alpha$  on CES items was .93.

The *Posttraumatic Stress Disorder Checklist—Military Version* (PCLM<sup>17</sup>) is a 17-item screening instrument based on diagnostic criteria for PTSD. Respondents who scored  $\geq 50$  and who met B, C, and D criteria for PTSD were identified as screening positive for PTSD. This definition provides a conservative estimate of the prevalence of PTSD, which corresponds to Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition criteria for PTSD. Cronbach’s  $\alpha$  on PCL-M items was .96.

The *Patient Health Questionnaire—9* (PHQ-9<sup>18</sup>) is a nine-item self-report screening instrument for depression derived from the clinician-administered Primary Care Evaluation of Mental Disorders. Higher scores indicate greater depressive symptoms, with scores  $\geq 15$  indicating a positive screen for depression. Cronbach’s  $\alpha$  on these items was .92.

The *Unit Support Scale* (USS) is a 12-item self-report instrument from the DRRI<sup>15,16</sup> that assesses the amount of assistance and encouragement in the war zone from unit leaders and members, and the military in general. Questions include, “My unit was like a family to me,” “My superiors made a real attempt to treat me as a person,” and “I could go to most people in my unit for help when I had a personal problem.” A validation study in Gulf War veterans found that scores on the USS correlate negatively with measures of PTSD, depression, and anxiety.<sup>15</sup> In this sample, Cronbach’s  $\alpha$  on USS items was .93.

The *Postdeployment Social Support Scale* (PSSS) is a 15-item self-report measure from the DRRI<sup>15,16</sup> that assesses postdeployment emotional support and instrumental assistance provided by family, friends, coworkers, employers, and community. Validation studies in OIF and Gulf War veterans found that PSSS scores correlated negatively with measures of PTSD, depression, and physical symptoms and positively with measures of physical, mental, and cognitive functioning.<sup>15,16</sup> In this sample, Cronbach’s  $\alpha$  on these items was .82.

## DATA ANALYSIS

Logarithmic base 10 transformations were used to transform nonnormally distributed continuous variables (e.g., PCL-M scores) prior to analysis. Demographic characteristics were compared using independent-samples  $t$  tests and  $\chi^2$  tests. Scores on each of the CDRISC items by PTSD status were compared using univariate analyses of covariance (two-tailed,  $\alpha=0.05$ ) with demographic variables that differed between the groups entered as covariates. Cohen’s  $d$  values ( $[\text{Mean}_{\text{group1}} - \text{Mean}_{\text{group2}}] / \text{pooled standard deviation}$ ) were computed to estimate effect sizes of group differences.<sup>19</sup> Post hoc  $t$  tests were used to compare total CD-RISC scores to norms reported in Connor and Davidson<sup>14</sup> and to examine group differences on individual CD-RISC items, with  $P < .01$  considered significant in the latter analyses.

Hierarchical regression analyses were conducted to examine predictors of traumatic stress and depressive symptom severity. All respondents, including those with and without PTSD and with and without positive screens for depression, were included in these analyses. Continuous scores on the PCL-M and PHQ-9 were entered as dependent variables in separate analyses. Variables hypothesized to be related to PTSD and depressive symptoms were entered as independent variables. Step 1 included demographic variables (age, sex, race/ethnicity, education, relationship status, duty type: active versus reserve), Step 2 included a measure of combat exposure (CES), and Step 3 included potentially protective factors (USS, PSSS, CDRISC). Complete data were available for 255 respondents.

## RESULTS

### DEMOGRAPHIC CHARACTERISTICS, COMBAT EXPERIENCE SEVERITY, AND PSYCHOSOCIAL MEASURES

In the full sample, mean age was 34.9 ( $SE = .4$ ), 89.4% were white, 82.4% completed at least some college education, 27.8% were active duty, and 72.2% were in the National Guard or Reserves; 87.4% were in the Army, 9.1% Marines, 2.2% Air Force, and 1.3% multiple branches. Demographic characteristics and scores on combat experience and psychosocial measures by PTSD status are given in Table 1. The PTSD group was younger than the no PTSD group, but did not differ by sex, race/ethnicity, education, relationship status, and service type. They scored higher on the CES (large effect size), and lower on the postdeployment social support (large effect size) and unit support (medium effect size) measures.

Mean PCL-M scores were 35.9 ( $SD = 18.0$ ) for the full sample, 64.3 ( $SD = 10.2$ ) for respondents with PTSD, and 27.8 ( $SD = 9.7$ ) for respondents without PTSD. Mean PHQ-9 scores were 7.3 ( $SD = 6.9$ ) for the full sample, with respondents with PTSD ( $M = 16.5$ ,  $SD = 5.9$ ) scoring higher than re-

spondents without PTSD ( $M = 4.6$ ,  $SD = 4.4$ ;  $t = 16.96$ ,  $P < .001$ ,  $d = 2.29$ ). Forty-three (15.8%) respondents in the full sample screened positive for depression, with respondents with PTSD more likely than those without PTSD to have a positive screen (56.7 versus 4.3%,  $\chi^2(1) = 95.63$ ,  $P < .001$ ). Combat experience, unit support, and postdeployment social support scores were consistent with those observed in other veteran samples.<sup>15,16,20</sup>

CD-RISC scores by PTSD status are given in Table 2 (page 70). The mean resilience score in the full sample was 73.8 ( $SD = 16.1$ ). Compared to normative scores reported in Connor and Davidson,<sup>14</sup> this score is lower than that of the general population ( $M = 80.4$ ,  $SD = 12.8$ ;  $t = 6.44$ ,  $P < .001$ ) and higher than that of psychiatric outpatients ( $M = 68.0$ ,  $SD = 15.3$ ;  $t = 2.21$ ,  $P = .028$ ), but consistent with that of primary-care patients ( $M = 71.8$ ,  $SD = 18.4$ ;  $t = 1.13$ ,  $P = .26$ ). The mean score of the no PTSD group was lower than that of the general population ( $t = 2.90$ ,  $P = .004$ ), but higher than that of psychiatric outpatients ( $t = 4.38$ ,  $P < .001$ ). The mean score of the PTSD group was consistent with that of civilian GAD ( $t = 1.29$ ,  $P = .20$ ) and PTSD patients ( $t = 0.65$ ,  $P = .51$ ). The PTSD group scored lower than the no PTSD group on total CD-RISC scores and on all of the factor scores except spiritual influences. Post hoc  $t$  tests showed that respondents endorsed lower ratings on all of the resilience items (all  $P$ s  $< .001$ ), except “Fate or God can help” ( $P = .70$ ), “I sometimes have to act on a hunch” ( $P = .08$ ), and “Most things happen for a reason” ( $P = .02$ ).

scales of the CD-RISC were associated with PCL- $M$  scores. The subscales personal control ( $\beta = -.39$ ,  $t = 4.95$ ,  $P < .001$ ) and acceptance of changes ( $\beta = -.37$ ,  $t = 4.58$ ,  $P < .001$ ) were significantly negatively associated with PTSD symptoms; personal competence/tenacity, trust instincts/tolerate negative affect, and spiritual influences were not (all  $\beta$ s  $< .16$ , all  $t$ s  $< 1.55$ , all  $P$ s  $> .12$ ).

Higher scores on measures of resilience ( $\beta = -.37$ ,  $t = 4.89$ ,  $P < .001$ ) and postdeployment social support ( $\beta = -.23$ ,  $t = 3.17$ ,  $P < .001$ ) were also negatively associated with depressive symptoms assessed by the PHQ-9, even after adjusting for all of the covariates given in Table 3. The subscales personal control ( $\beta = -.26$ ,  $t = 2.69$ ,  $P = .008$ ) and acceptance of change ( $\beta = -.21$ ,  $t = 2.15$ ,  $P = .033$ ) were negatively associated with depressive symptoms, but the other subscales were not (all  $\beta$ s  $< .13$ , all  $t$ s  $< 1.39$ , all  $P$ s  $> .17$ ).

## DISCUSSION

To our knowledge, this is one of the first studies of OEF/OIF veterans to examine the relationship between protective factors such as psychological resilience and social support, and traumatic stress and depressive symptoms. Overall, OEF/OIF veterans reported a level of resilience consistent with civilian outpatient primary-care patients, but veterans with PTSD reported lower levels of resilience and unit and postdeployment social support compared to veterans without PTSD. Increased resilience and postdeployment social support were negatively associated with severity of traumatic stress and de-

**TABLE 1. Demographic, combat experience, and social support measures by PTSD status**

	No PTSD	PTSD	$F$ or $\chi^2$	$P$	$d$
$N$	225	59			
Age*	34.0 (0.6)	31.1 (1.2)	4.55	.03	
Sex (% male)	88.8%	91.5%	0.36	.55	
Race/ethnicity			3.17	.37	
White	82.7%	73.3%			
Black	5.3%	10.0%			
Hispanic	5.8%	6.7%			
Other	6.2 %	10.0%			
Education			3.80	.15	
High school	18.2%	27.1%			
Some college/college graduate	70.2%	67.8%			
Graduate school	11.6%	5.1%			
Married/living w/partner	53.8%	55.2%	0.04	.85	
Service duty			2.88	.09	
Active duty	27.0%	39.6%			
National Guard or reserves	73.0%	60.4%			
Combat experiences score*	36.1 (2.0)	50.9 (1.1)	43.38	<.001	0.99
Postdeployment social support score*	57.6 (0.7)	47.5 (1.3)	49.30	<.001	1.02
Unit support score*	42.9 (0.8)	35.7 (1.5)	16.76	<.001	0.60

\*Groups differ,  $P < .05$ ; mean scores on combat experiences, psychosocial difficulties, postdeployment social support, and unit support scales are adjusted for age.  $d$  = Cohen's  $d$  estimate of effect size of group difference. PTSD, posttraumatic stress disorder.

Table 3 (page 70) shows the results of a hierarchical regression analysis that examined predictors of PCL- $M$  scores in the full sample. Increased combat experience scores were positively associated and postdeployment social support and resilience scores were negatively associated with PTSD symptoms. A separate regression analysis evaluated which sub-

pressive symptoms, even after controlling for demographic characteristics and combat exposure severity.

The mean resilience score in this sample of OEF/OIF veterans is consistent with that observed in primary-care patients.<sup>14</sup> The mean score of the group without PTSD was between that observed in the general population and primary-care



**TABLE 2. Means and standard errors on CD-RISC by PTSD status**

	No PTSD	PTSD	<i>F</i> (1, 266)	<i>P</i>	<i>d</i>
Total resilience score*	77.4 (1.0)	59.5 (2.0)	65.29	<.001	1.08
Personal competence*	25.9 (0.3)	20.1 (0.7)	56.14	<.001	1.05
I work to obtain my goals	3.2 (0.0)	2.3 (0.1)			
When things look hopeless, I don't give up	3.2 (0.0)	2.4 (0.1)			
I believe I can achieve my goals	3.2 (0.0)	2.8 (0.1)			
I take pride in my achievements	3.5 (0.0)	2.7 (0.1)			
I give my best effort no matter what	3.2 (0.0)	2.8 (0.1)			
I like challenges	3.1 (0.1)	2.2 (0.1)			
I think of myself as strong person	3.4 (0.0)	2.5 (0.1)			
I am not easily discouraged by failure	3.0 (0.1)	2.3 (0.2)			
Tolerance of negative affect and stress-related growth*	21.6 (0.3)	17.2 (0.6)	37.86	<.001	0.78
I sometimes have to act on a hunch	2.7 (0.1)	2.5 (0.2)			
I can make unpopular or difficult decisions	3.3 (0.0)	2.8 (0.1)			
I prefer to take the lead in problem solving	3.2 (0.0)	2.6 (0.1)			
I see the humorous side of things	3.0 (0.1)	2.4 (0.1)			
I believe coping with stress strengthens me	2.9 (0.1)	2.1 (0.2)			
I can handle unpleasant feelings	3.1 (0.0)	2.5 (0.2)			
Under pressure, I can focus and think clearly	3.2 (0.0)	2.3 (0.1)			
Acceptance of changes*	16.3 (0.2)	12.5 (0.4)	59.43	<.001	1.03
I am able to adapt to change	3.2 (0.1)	2.6 (0.1)			
I can deal with whatever comes my way	3.3 (0.0)	2.6 (0.1)			
Past success gives me confidence for new challenges	3.3 (0.0)	2.4 (0.1)			
I have close and secure relationships	3.2 (0.1)	2.5 (0.2)			
I tend to bounce back after illness or hardship	3.2 (0.0)	2.3 (0.2)			
Personal control*	9.0 (0.2)	5.5 (0.3)	89.84	<.001	1.44
I am in control of my life	3.0 (0.1)	1.8 (0.1)			
I know where to turn for help	3.0 (0.1)	1.9 (0.0)			
I have a strong sense of purpose	3.0 (0.1)	1.7 (0.1)			
Spiritual orientation to the future	4.6 (0.1)	4.1 (0.3)	1.83	.19	0.21
I believe that sometimes fate or God can help me	1.8 (0.1)	1.8 (0.2)			
I believe things happen for reason	2.8 (0.1)	2.3 (0.2)			

\*Groups differ,  $P < .05$ ; all scores adjusted for age.  $d$  = Cohen's  $d$  estimate of effect size of group difference. CD-RISC, Connor-Davidson Resilience Scale; PTSD, posttraumatic stress disorder.

**TABLE 3. Predictors of traumatic stress symptom severity in the full sample**

	<i>F</i> , <i>P</i>	<i>R</i> <sup>2</sup>	$\beta$	<i>t</i>	<i>P</i>
Step 1	2.01, .08	.03			
Age			-.11	1.86	.06
Race/ethnicity (White versus other)			-.03	0.59	.55
Education (no college versus college)			.07	1.26	.21
Relationship status (no versus yes)			-.05	0.82	.41
Duty type (reserve versus active)			.07	1.21	.23
Step 2*	6.49, <.001	.15			
Combat Experiences Scale*			.34	4.98	<.001
Step 3*	16.35, <.001	.43			
Unit support			.05	0.85	.40
Postdeployment social support*			-.31	4.55	<.001
Resilience*			-.34	4.98	<.001

\*Statistically significant predictor of PCL-M scores,  $P < .001$ . PCL-M, Posttraumatic Stress Disorder Checklist—Military Version.

patients, whereas the mean score of the group with PTSD was consistent with that observed in civilian PTSD patients.<sup>14</sup> These findings suggest that OEF/OIF veterans are quite resilient despite having endured war. However, the PTSD group scored more than one full standard deviation lower than the no PTSD group, suggesting that this group may be less hardy or resilient to stress, a finding consistent with previous reports.<sup>14</sup> The most pronounced difference between the PTSD and no PTSD groups was on the CD-RISC subscale personal control, which assesses the extent to which an individual feels in control of his or her life, knows where to turn for help, and has a sense of purpose in their life. This finding corroborates previous reports showing that individuals with PTSD tend to have lower coping self-efficacy compared to individuals without PTSD.<sup>21,22</sup> Lower coping self-efficacy, in turn, has been linked to greater distress, intrusion, and avoidance symptoms,<sup>21</sup> even at 2 years posttrauma.<sup>23</sup> Veterans with PTSD in this study also scored lower on measures of unit support and postdeployment social support, which is consistent with previous studies demonstrating moderate correlations between these measures and PTSD symptoms.<sup>15,16,20</sup>

Higher resilience and postdeployment social support scores were associated with decreased traumatic stress and depressive symptoms, even after controlling for demographic factors and combat exposure. The subscales personal control and acceptance of changes were the only two CD-RISC subscales associated with traumatic stress. This finding is consistent with Bandura's<sup>24</sup> social cognitive theory, which maintains that beliefs about one's capacity to manage and control events in life are important in determining behavioral and affective responses to highly stressful situations. For example, in a study of 600 sexual assault survivors, the only protective factor against PTSD symptoms was survivors' perception that they had greater control over the recovery process.<sup>25</sup> In a study of Israeli recruits, perceived control predicted positive changes in mental health over the course of an intense 4-month combat training period, with these changes mediated by reduced appraisal of threat and the use of problem solving and support-seeking strategies.<sup>26</sup> Individuals with high perceived control also tend to seek positive solutions to problems by using active rather than passive coping mechanisms,<sup>27</sup> which promotes greater self-efficacy and decreases risk for PTSD.<sup>28</sup> Taken together, these findings underscore the importance of cognitive-behavioral interventions that promote perceptions of control and self-efficacy, encourage positive appraisals and acceptance of change, and increase adaptive coping strategies in individuals with PTSD.<sup>29</sup> One example of such an intervention is well-being therapy, which focuses on enhancing personal growth, purpose in life, autonomy, self-acceptance, and positive relations with others, and has been shown to improve symptoms associated with mood and anxiety disorders.<sup>30</sup> Postdeployment social support was also negatively associated with traumatic stress and depressive symptoms, which suggests that efforts to enhance social support and help veterans learn how to seek out social support may be effective in reducing the negative impact of traumatic stress.

It is likely that resilience and social support operate in concert with one another to reduce the likelihood of developing trauma-related psychopathology. A previous study of a nationally representative sample of 1,632 Vietnam veterans

similarly found that hardiness and postwar social support were negatively associated with PTSD symptoms and that functional social support accounted for a substantial amount of the indirect effect of hardiness on PTSD.<sup>4</sup> This finding is consistent with reports that individuals who are resilient to stress tend to be skilled at constructing social networks and seeking out social support in times of need.<sup>4,27,31</sup> Of note, in this study, the magnitude of the association between resilience and traumatic stress symptoms ( $\beta = -.34$ ) was equal to that between combat exposure severity and traumatic stress symptoms ( $\beta = .34$ ). This suggests that efforts to promote psychological resilience may help counteract the potentially deleterious effect of combat exposure on the development of traumatic stress and related symptoms.

Psychological resilience and social support may be protective against traumatic stress and depressive symptoms by improving emotional regulation, decreasing fear-related appraisals and cognitions, promoting cognitions that the world is safe and nonthreatening, enhancing self-efficacy and control,<sup>5</sup> and decreasing hypothalamic-pituitary-adrenal axis reactivity<sup>32-34</sup> and stress-related physiological arousal.<sup>35,36</sup> Resilience is also related to active task-oriented coping,<sup>37</sup> which may enhance adaptation to stress by decreasing avoidance symptoms, behavioral withdrawal, and emotional disengagement.<sup>5,38</sup> Further research is needed to examine interrelationships among these biological factors, resilience, social support, and stress-related disorders.

Methodological limitations of this study must be noted. First, the generalizability of these results may be limited, as the response rate to the survey was relatively low, respondents were older than nonrespondents, only data on age of nonrespondents were recorded, and the sample was ethnically and geographically homogeneous. The reasons for this low response rate are not entirely clear, but may be related to the length of the survey, which included more than 200 questions. Second, PTSD status was determined using a strict method, which required respondents to score  $\geq 50$  and meet B, C, and D criteria. Thus, when less strict methods of classification are used, individuals with PTSD will likely report higher levels of resilience and/or social support. Third, only a select number of measures of psychological resilience and social support were administered. Because these constructs are multidimensional, more research using a broader array of these types of measures and employing analytic methods such as structural equation modeling may be helpful in elucidating the complex interrelationships among these variables. For example, one may examine the possibility that more resilient individuals attract more social support, which in turn decreases traumatic stress and depressive symptoms, and that individuals with increased traumatic stress and depressive symptoms may be less resilient and in turn less able to garner postdeployment social support. Fourth, the subscales of the CD-RISC in this study were drawn from the original publication of this instrument, which derived these subscales using exploratory factor analysis.<sup>14</sup> Confirmatory factor analytic studies are needed to examine the factor structure of the CD-RISC and other measures of resilience and social support in military samples. Finally, the cross-sectional nature of this study precluded examination of the temporal association between resilience, social support, and PTSD/depressive symptoms. Longitudinal studies are

needed to examine whether resilience and support factors do in fact protect PTSD/depressive symptoms or whether individuals with PTSD/depressive symptoms perceive themselves as less resilient and having less social support.

Despite these limitations, this study is among the first to examine adaptive aspects of recovery from combat and the importance of resilience and social support in protecting against traumatic stress and depressive symptoms in OEF/OIF veterans. Given the low response rate to the survey employed in this study, future research should endeavor to replicate these findings in larger, more representative samples of OEF/OIF veterans as well as in other military and civilian populations, examine specific roles of protective factors in mitigating psychopathology and functioning, and develop and test the efficacy of preventive and treatment interventions designed to bolster resilience and social support in veteran and other trauma-exposed populations.

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# PSYCHOSOCIAL BUFFERS OF TRAUMATIC STRESS, DEPRESSIVE SYMPTOMS, AND PSYCHOSOCIAL DIFFICULTIES IN VETERANS OF OPERATIONS ENDURING FREEDOM AND IRAQI FREEDOM: THE ROLE OF RESILIENCE, UNIT SUPPORT, AND POSTDEPLOYMENT SOCIAL SUPPORT

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## ABSTRACT

**Background:** Little research has examined the role of protective factors such as psychological resilience, unit support, and postdeployment social support in buffering against PTSD and depressive symptoms, and psychosocial difficulties in veterans of Operations Enduring Freedom (OEF) and Iraqi Freedom (OIF). **Materials and methods:** A total of 272 OEF/OIF veterans completed a survey containing PTSD and depression screening measures, and questionnaires assessing resilience, social support, and psychosocial functioning. **Results:** Lower unit support and postdeployment social support were associated with increased PTSD and depressive symptoms, and decreased resilience and psychosocial functioning. Path analyses suggested that resilience fully mediated the association between unit support and PTSD and depressive symptoms, and that postdeployment social support partially mediated the association between PTSD and depressive symptoms and psychosocial functioning. **Limitations:** Generalizability of results is limited by the relatively low response rate and predominantly older and reserve/National Guard sample. **Conclusions:** These results suggest that interventions designed to bolster unit support, resilience, and postdeployment support may help protect against traumatic stress and depressive symptoms, and improve psychosocial functioning in veterans.

## 1. INTRODUCTION

Epidemiologic surveys of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) veterans have found high rates of posttraumatic stress disorder (PTSD), depression, and related conditions (Tanielian and Jaycox, 2008). While it is well known that these conditions may negatively affect psychosocial functioning and quality of life in this population (e.g., Milliken et al., 2007), little research has examined the role of protective factors such as psychological resilience, unit support, and postdeployment social support in buffering against PTSD and depressive symptoms, and psychosocial difficulties.

Psychological resilience, which refers to an individual's capacity to successfully adapt or change in the face of adversity, protects against the development of combat-related PTSD in Vietnam veterans (King et al., 1998; Waysman et al., 2001) and Army Reserve Soldiers (Bartone, 1999). Aspects of resilience such as positive emotions, cognitive flexibility, meaning making, and active coping also protect against the deleterious effects of depression (Southwick et al., 2005).

Social support also protects against depression (Paykel, 1994; Southwick et al., 2005), and PTSD, with meta-analyses suggesting that it is among the strongest negative predictors of PTSD (Oliver et al., 1999; Brewin et al., 2000; Ozer et al., 2008). Higher perceived social support has also been linked to increased resilience (Bonanno et al., 2007) and lower risk of PTSD in Vietnam veterans (King et al., 1998), prisoners of war (Engdahl et al., 1997) and United Nations soldiers (Kaspersen et al., 2003). An understanding of associations between resilience, social support, PTSD and depressive symptoms, and functioning in OEF/OIF veterans is important, as it may help guide the development of interventions to enhance resilience and support, and promote successful readjustment to civilian life after deployment.

This study examined associations between resilience, unit support, postdeployment social support, traumatic stress and depressive symptoms, and psychosocial functioning two years following return from deployment in a sample of OEF/OIF veterans. Path analyses tested the hypotheses that unit support may help enhance psychological resilience (Bartone, 2006; Oliver et al., 1999), which in turn reduces PTSD and depressive symptom severity, and that postdeployment social support may mediate the relationship between PTSD and depressive symptoms and psychosocial difficulties (Oxman and Hull, 2001; Zatzick et al., 1997). We hypothesized that resilience would mediate the relationship between unit support and PTSD and depressive symptoms, and that postdeployment social support would mediate the relationship between PTSD and depressive symptoms and psychosocial difficulties.

## 2. METHODS

### 2.1. Sample

Participants (N=272) completed the Connecticut OEF/OIF Veterans Needs Assessment Survey. OEF/OIF veterans were identified alphabetically from a review of copies of discharge papers (DD-214s) by the Connecticut Department of Veterans' Affairs until names and addresses of 1000 potential respondents were obtained. To maintain confidentiality, surveys were addressed and mailed by the Connecticut Department of Veterans' Affairs. No personal identifying information was made available to the authors. The survey was mailed in October 2007 to a sample of 1000 veterans who had served between 1/1/03 and 3/1/07; as of 2/08, 285 surveys were returned for an overall return rate of 28.5%. Respondents were older than non-respondents in the sampling frame (33.4 vs. 31.3 years,  $t(998)=2.87, p=.004$ ). On

average, time between return from deployment to OEF/OIF and survey completion was 26.9±.7 months.

## 2.2. Assessment instruments

The Unit Support Scale (USS) is a self-report measure from the Deployment Risk and Resilience Inventory (DRRI; King et al., 2006) that assesses the quality of relationships and degree of cohesion between a Soldier and his/her unit. Cronbach's  $\alpha=.93$ .

The Postdeployment Social Support Scale is a self-report measure from the DRRI that assesses the extent to which family, friends, coworkers, employers, and community provide postdeployment emotional support and instrumental assistance. Cronbach's  $\alpha=.82$ .

The *Connor–Davidson Resilience Scale* (Connor and Davidson, 2003) is a self-report measure of psychological resilience. Higher scores reflect greater resilience. Cronbach's  $\alpha=.94$ .

The *Combat Experiences Scale* (CES) is a self-report instrument from the DRRI that assesses exposure to combat (e.g., firing a weapon, witnessing injury and death). Higher scores reflect more combat exposure. Cronbach's  $\alpha=.93$ .

The *Posttraumatic Stress Disorder Checklist-Military Version* (PCL-M; Weathers et al., 1991) is a 17-item instrument based on DSM-IV criteria for PTSD. Higher scores indicate greater posttraumatic stress symptoms. Cronbach's  $\alpha=.96$ .

The *Patient Health Questionnaire-9* (Kroenke and Spitzer, 2002) is a 9-item self-report screening instrument for depression derived from the clinician-administered Primary Care Evaluation of Mental Disorders. Higher scores indicate greater depressive symptoms. Cronbach's  $\alpha=.92$ .

The *Psychosocial Difficulties Scale* (PDS) is a 23-item questionnaire developed by two of the authors (M.B.G., J.C.M.) that assesses psychosocial functioning in family and peer relationships (e.g., “have difficulty connecting emotionally with family and/or friends”), and work, school, and financial functioning (e.g., “have difficulty finding employment”; “have difficulty paying bills”). Ratings are “Not a concern”, “A slight concern”, “A moderate concern”, and “A major concern”. Higher scores indicate greater psychosocial difficulties. Cronbach's  $\alpha=.89$ .

## 2.3. Data analysis

Non-normally distributed data (e.g., PCL-M scores) were transformed using logarithmic base 10 transformations. Pearson correlations were computed between measures of social support and resilience, PTSD and depressive symptoms, and psychosocial difficulties. Path analyses were conducted to test the hypotheses that resilience mediates the relationship between unit support and PTSD and depressive symptoms; and that postdeployment social support mediates the relationship between PTSD and depressive symptoms and psychosocial difficulties. Data from all respondents were included in these analyses, including those with and without positive screens for PTSD and depression. Model fit was evaluated using a number of fit statistics, including  $\chi^2$ , root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker–Lewis Index (TLI). By convention, lower, non-significant  $\chi^2$  values, RMSEA values  $\leq .08$ , and CFI and TLI values  $\geq .90$  indicate acceptable model fit (Kline, 2005). Path coefficients are presented as standardized regression weights ( $\beta$ ).

## 3. RESULTS

The mean age of the total sample was 34.9±.4 years, 89% were white, 82% completed at least some college education, the majority (72%) were in the National Guard or reserves and 28% were on active duty; 87% were in the Army, 9% Marines, 2% Air Force, and 2% multiple branches.

Table 1 shows mean scores and standard errors, and correlations between all measures. Unit support scores correlated with scores on all other variables except combat exposure and psychosocial difficulties. Postdeployment social support scores correlated positively with resilience scores and negatively with scores on all other variables. Resilience scores correlated negatively with measures of PTSD and depressive symptoms, and psychosocial difficulties, but they were not associated with combat exposure. Combat exposure scores correlated negatively with postdeployment social support scores and positively with measures of PTSD and depressive symptoms, and psychosocial difficulties. PTSD and depressive symptoms correlated positively with scores on a measure of psychosocial difficulties.

**Table 1**  
Mean scores and correlations between variables.

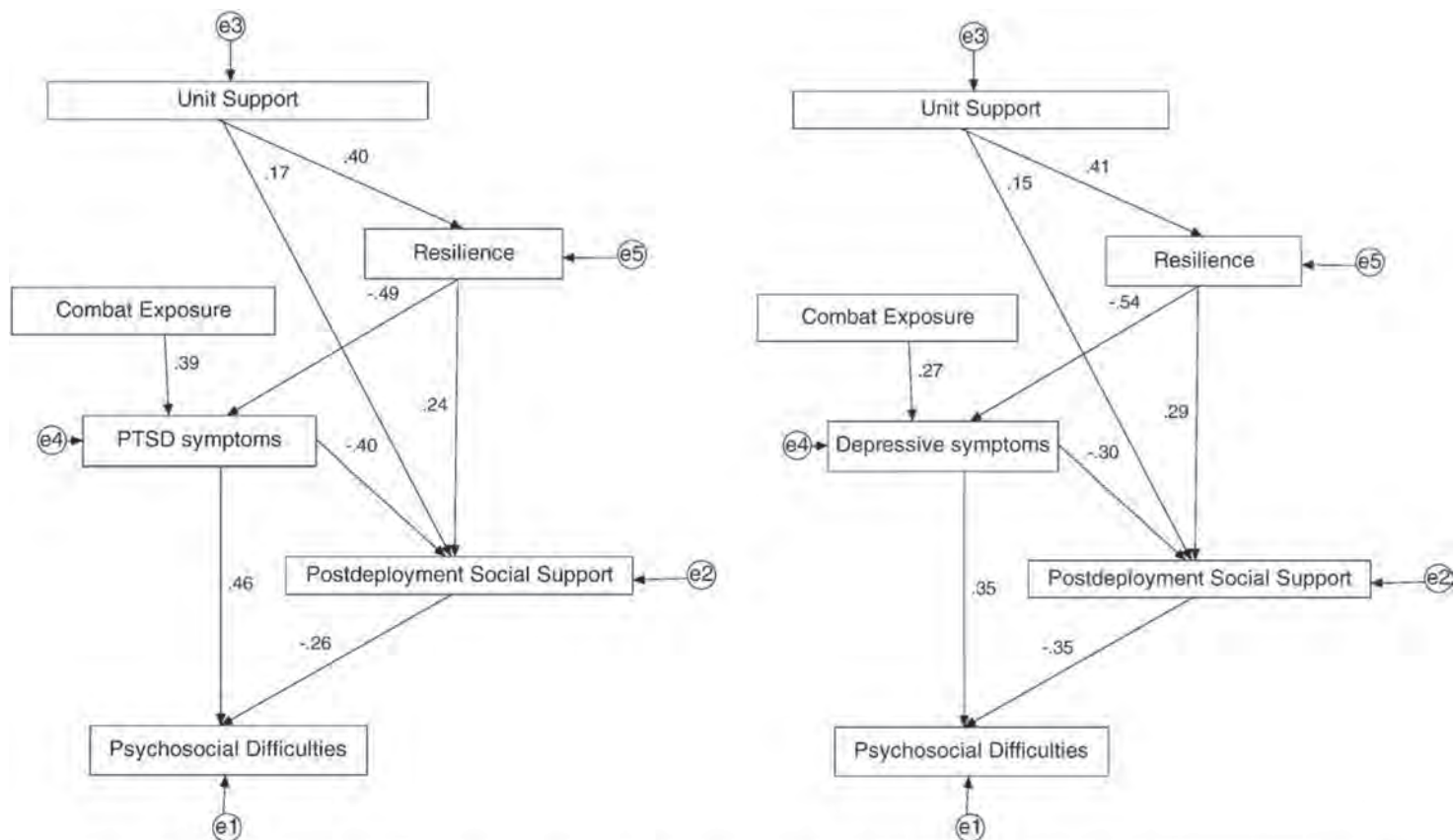
	Mean (SD)	Postdeployment social support	Resilience	Combat exposure	PTSD symptoms	Depressive symptoms	Psychosocial difficulties
Unit support	41.3 (11.9)	.36 **	.40 **	.05	-.23 **	-.31 **	-.12
Postdeployment social support	55.4 (10.5)		.51 **	-.19 *	-.56 **	-.53 **	-.53 **
Resilience	73.8 (16.1)			.04	-.53 **	-.57 **	-.40 **
Combat exposure	39.5 (16.7)				.41 **	.31 **	.28 **
PTSD symptoms	35.9 (18.0)					.79 **	.62 **
Depressive symptoms	7.3 (6.8)						.55 **

Note. PTSD = posttraumatic stress disorder; SD = standard deviation.

\*  $p < .01$ .

\*\*  $p < .001$ .





**Fig. 1.** Path diagrams showing relationships among support variables, resilience, PTSD and depressive symptoms, and psychosocial functioning.

Fig. 1 shows the final path models, both of which had a good fit: PTSD symptom model:  $\chi^2(7)=4.78$ ,  $p=.69$ ; RMSEA=.00, CFI=1.00, TLI=1.00; Depressive symptom model:  $\chi^2(7)=5.86$ ,  $p=.12$ ; RMSEA=.04; CFI=.99; TLI=.96. All paths in the final models were statistically significant (all  $p$ 's > .05). In the just-identified models (i.e., perfect fit to data with paths between all variables), the paths between unit support and PTSD and depressive symptoms, combat exposure and unit support, resilience, and functioning, and resilience and functioning were not significant (all  $\beta$ 's < .06, all  $p$ 's > .26); accordingly, these paths were removed from the final models. As shown in Fig. 1, resilience fully mediated the relationship between unit support and both PTSD and depressive symptoms; unit support also predicted increased postdeployment social support. Combat exposure was associated with increased PTSD symptoms, resilience with increased postdeployment social support, and PTSD and depressive symptoms with greater psychosocial difficulties. Postdeployment social support partially mediated the association between PTSD and depressive symptoms and psychosocial difficulties.

#### 4. DISCUSSION

This study examined the role of protective factors such as resilience and social support in protecting against traumatic stress and depressive symptoms, and psychosocial difficulties in OEF/OIF veterans. Results suggested that resilience, unit support, and postdeployment social support

serve as psychosocial buffers of PTSD and depressive symptoms, and psychosocial difficulties at 2 years after deployment.

Resilience fully mediated the relationship between unit support and PTSD and depressive symptoms. Previous research on resilience similarly found that social support is associated with increased resilience (Bonanno et al., 2007; Oliver et al., 1999) and lower risk of PTSD in military samples (King et al., 1998; Engdahl et al., 1997; Kaspersen et al., 2003). This finding suggests that high levels of perceived unit support were associated with increased resilience, which in turn is associated with decreased PTSD and depressive symptoms. Unit support may enhance resilience by promoting feelings of personal control and self-efficacy, which may foster the development of active coping styles and increased ability to reappraise stressful situations (Sumer et al., 2005; Benight and Harper 2002; Southwick et al., 2005; Bartone, 2006). Unit support may also bolster resilience by promoting meaning-making in the face of stressful experiences (Cole et al., 2006). While more research is needed to tease apart the temporal relationship between unit support and resilience (i.e., does unit support lead to increased resilience or do more resilient people attract more unit support?), this finding highlights the importance of unit support and resilience in protecting against PTSD and depressive symptoms in OEF/OIF veterans.

Postdeployment social support partially mediated the relationship between PTSD and depressive symptoms and psychosocial difficulties. This finding replicates previous research demonstrating the protective role of social support in preserv-

ing functioning in both PTSD (Zatzick et al., 1997) and depression (Taylor, 2004; Oxman and Hull, 2001). It also suggests that providing early social support may reduce the documented postdeployment increase in PTSD symptoms and comorbid conditions for OEF/OIF veterans (Milliken et al., 2007). Social support may enhance functioning by fostering effective coping strategies (Holahan et al., 1995), reducing involvement in high-risk behaviors or avoidance coping (Muris et al., 2001), promoting self-efficacy (Hays et al., 2001), and reducing loneliness (Bisschop et al., 2004). Resilience and social support likely operate synergistically to decrease the likelihood of developing PTSD and depression. Indeed, a study of a nationally representative sample of 1632 Vietnam veterans found that both hardiness, an aspect of resilience, and postwar social support were negatively associated with PTSD symptoms, and that social support accounted for a substantial amount of the indirect effect of hardiness on PTSD (King et al., 1998).

The finding that increased resilience was associated with increased postdeployment social support also corroborates previous research, which found that resilient individuals tend to be skilled at constructing social networks and seeking out social support in times of need (Sharkansky et al., 2000). Resilience and social support may also protect against PTSD and depressive symptoms and enhance functioning by decreasing hypothalamic–pituitary–adrenal (HPA) axis reactivity and stress-related physiological arousal (Heinrichs et al., 2003; Southwick et al., 2005). They may also promote active task-oriented coping (Campbell-Sills et al., 2006), which enhances adaptation to stress by decreasing avoidance symptoms, behavioral withdrawal, and emotional disengagement (Southwick et al., 2005; Tiet et al., 2006).

Methodological limitations of this study must be noted. First, given the relatively low response rate to the survey, generalizability of the findings may be limited. Nevertheless, demographic, deployment, and clinical characteristics of survey respondents in the current study were generally comparable to those of a nationally representative sample of OEF/OIF veterans (Tanielian and Jaycox, 2008), though the current survey sample consisted of older, and predominantly white and Army Reserve/National Guard veterans, so results are likely best generalized to this population. Second, self-report screening instruments were used to assess PTSD and depression symptoms. Whether these results are generalizable to larger, predominantly active duty, and/or more diverse samples of OEF/OIF veterans when formal clinical interviews and diagnostic instruments are utilized remains to be examined. Finally, due to the cross-sectional design of this study, we were unable to examine temporal relationships among the variables assessed. More research is needed to examine the interrelationships among these variables with respect to deployment. For example, it is not clear whether unit support enhances resilience or if resilient individuals are better able to attract unit support. Future research should also employ a broader array of biological and psychosocial measures, including measures of successful adjustment, in examining predictors of psychological symptoms/disorders and functioning, and evaluate the utility of interventions designed to bolster unit support, resilience, and postdeployment social support in

improving readjustment to civilian life in OEF/OIF veterans and other trauma-exposed populations.

#### ROLE OF FUNDING SOURCE

None of these funding sources had a role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

#### CONFLICT OF INTEREST

None of the authors have any conflicts of interest.

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# ***Editorials***

## **Editorial Comment on “Psychological Resilience and Postdeployment Social Support Protect Against Traumatic Stress and Depressive Symptoms in Soldiers Returning from Operations Enduring Freedom and Iraqi Freedom”**

*Depression and Anxiety* (Pietrzak et al., 2009a).

LTC Craig A. Myatt, PhD; Douglas C. Johnson, PhD

(The referred article can be read in this edition’s *Previously Published* section.)

Pietrzak et al. (2009a) used a cross-sectional methodological approach to support the premise that increased resilience and adequate social support protect against the potentially deleterious effects of traumatic stress. The emerging concern about behavioral health in servicemembers serving in Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) has prompted a wave of research that is now almost a 10 years in the making. Several studies introduced in the literature during that time examined post-traumatic stress disorder (PTSD), depression, and related psychopathological problems. However, prior to the Pietrzak et al. (2009a) study, no known research in OEF/OIF veterans examined variables that may confer protection against traumatic stress and depressive symptoms. Their study demonstrated that two key variables which appear to confer protection are psychological resilience and perceived social support.

Pietrzak et al. (2009a) hypothesized that OEF/OIF veterans with PTSD would score lower on measures of resilience and social support than veterans without PTSD. Their hypothesis also stated that increased resilience and social support would be negatively associated with severity of traumatic stress and depressive symptoms. They used the Post-traumatic Stress Disorder Checklist – Military Version (PCL-M) to measure PTSD and the Connor-Davidson Resilience Scale (CD-RISC) to measure psychological resilience in a battery of self-report assessments that also examined combat experiences, depressive symptoms, unit support, and post-deployment social support. The researchers

established a cut-off score on the PCL-M to identify veterans with PTSD. Among the 272 Active and Reserve component veterans from all services who participated in the study as volunteer respondents from the state of Connecticut, those in the PTSD group scored lower on the CD-RISC (less resilience) than those in the no-PTSD group. In addition, regression analysis techniques suggested that scores measuring psychological resilience on the CD-RISC and post deployment social support were negatively associated with PTSD and depressive symptoms.

The authors of the study adequately addressed the limitations in their study, one of which involved the cross-sectional nature of the study. The cross-sectional study provided a “snap-shot” in time on the behavioral health of OEF/OIF veterans. They addressed this limitation by emphasizing the need for longitudinal studies that examine the role of resilience and support factors over time. Pietrzak et al., (2009a) convincingly conclude that resilience and social support may be protective against traumatic stress and depressive symptoms by a host of mechanisms. Those mechanisms include: decreased hypothalamic-pituitary-adrenal axis reactivity, decreased stress related physiological arousal, decreased fear-related appraisals and cognitions, improved emotional regulation, and enhanced self-efficacy and control. Several of those mechanisms shed light on the importance of adopting a biopsychosocial perspective in the consideration of future research and applications.

## Editorial Comment on “Psychosocial Buffers of Traumatic Stress, Depressive Symptoms, and Psychosocial Difficulties in Veterans of Operations Enduring Freedom and Iraqi Freedom: The Role of Resilience, Unit Support, and Post-Deployment Social Support”

*Journal of Affective Disorders* (Pietrzak et al., 2009b).

LTC Craig A. Myatt, PhD; Douglas C. Johnson, PhD

(The referred article can be read in this edition’s *Previously Published* section.)

Resilience and social support appear to operate synergistically lowering the likelihood of developing posttraumatic stress disorder (PTSD) and depression, according to Pietrzak et al., (2009b). Their recent findings demonstrate that two key variables which appear to confer protection are psychological resilience and perceived social support. Pietrzak et al., (2009b) generated a two-part hypothesis stating, “... Resilience would mediate the relationship between unit support and PTSD and depressive symptoms, and that post-deployment social support would mediate the relationship between PTSD and depressive symptoms and psychosocial difficulties.” Resilience, unit support, PTSD, depressive symptoms, post-deployment social support, and psychosocial difficulties served as the six key factors in their hypothesis.

At approximately two years post-deployment for all participants, Pietrzak et al., (2009b) used the Connor-Davidson Resilience Scale (CD-RISC) to measure psychological resilience, the Unit Support Scale taken from the Deployment Risk and Resilience Inventory to measure unit support, the Post-traumatic Stress Disorder Checklist – Military Version (PCL-M) to measure PTSD, and the Patient Health Questionnaire-nine to measure depressive symptoms. The Post-deployment Social Support Scale measured social support following redeployment to home station duties and responsibilities, while the Psychosocial Difficulties Scale measured psychosocial functioning with family, peers, work, school, and finances. The Combat Experiences Scale (CES) was also used in the battery of self-report instruments to assess combat exposure.

Pietrzak et al., (2009b) obtained 272 Active and Reserve component veterans from all services as volunteer participants from the state of Connecticut after initial screening for 1000 potential volunteers among respondents to the Connecti-

cut OEF/OIF Veterans Needs Assessment Survey. Following PCL-M score, logarithmic base 10 transformations for PTSD data that showed a non-normal distribution, Pietrzak et al. (2009b) computed Pearson correlations between measures of resilience, unit support, PTSD, depressive symptoms, post-deployment social support, psychosocial difficulties, and combat exposure. Path analyses demonstrated that increased resilience was associated with less PTSD and fewer depressive symptoms, while increased post-deployment social support was associated with less PTSD and fewer depressive symptoms. Combat exposure scores correlated positively with measures of PTSD, depressive symptoms, and psychosocial difficulties, but correlated negatively with scores on post-deployment social support.

The findings of the Pietrzak et al. (2009b) study in the *Journal of Affective Disorders* demonstrate that resilience and social support lower the likelihood of developing PTSD and depressive symptoms in service members at two years post-deployment. Their conclusions suggest that resilience, unit support and other forms of social support (i.e., Family, peer, and financial) confer a synergistic protective role in service members. While the current study did not explore the synergistic relationship between resilience and social support in the Family members of the post-deployment veterans, its findings and conclusions offer compelling reasons for including Family members in the broader scope of research and applications. Finally, since hardiness as an aspect of resilience is negatively associated with PTSD symptoms (to include depressive behavior), the findings on combat exposure appear inconclusive. The reported combat exposure findings, nevertheless, provide a stimulating prospect for future study in demographically diverse groups that show high-versus low-hardiness and high-versus low-resilience.

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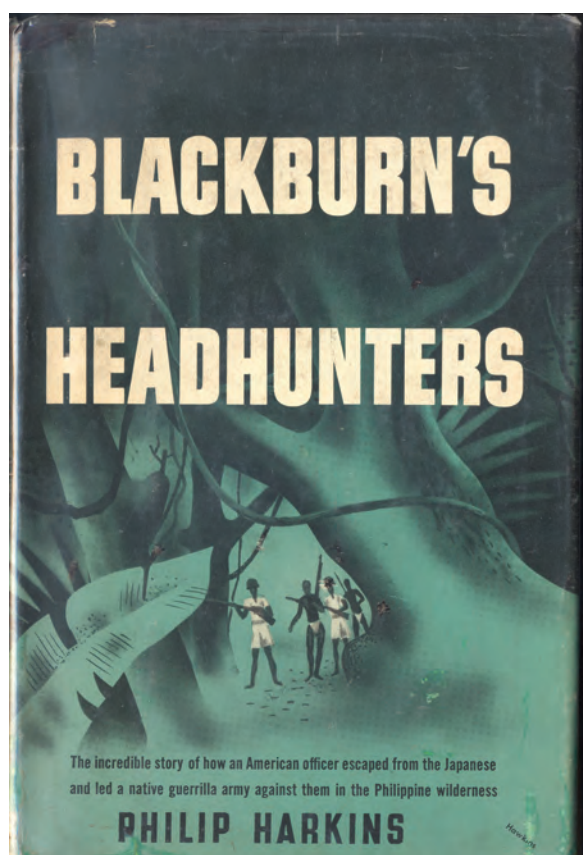
# *Book Reviews*

## **Blackburn's Headhunters**

Philip Harkins.

New York: W.W. Norton & Company, Inc., 1955. ISBN-10 1299651186, hardcover, 326 pages.

Reviewed by MAJ Pete Franco, MSC



*Blackburn's Headhunters* is the true story of Donald Blackburn. Blackburn was the Army Officer most responsible for pioneering guerilla warfare and insurgency operations in the Philippines after the Japanese invasion during WWII. The time span of this book runs from around the fall of Bataan to the liberation on VJ Day (approximately 1942-1945). Most of the book deals with Blackburn's training and integration of native Igorat and Ifugao Filipino tribes along with the training of regular Filipino soldiers and American Soldiers. The account starts as a narrative but then transitions to excerpts from

Blackburn's reports and diaries throughout the second half of the book.

The book begins with then 1LT Blackburn's arrival to the Philippine AOR on orders to train a section of the Philippine Army, the 12th Filipino Infantry Regiment. He was assigned with MAJ Russell Volckmann who together had responsibility for the 11th Filipino Infantry Regiment. Both Blackburn and Volckmann employed strong, early attempts to empower the Filipino Army; however, they failed to muster an initial force that could combat the Japanese. The book clearly illustrated the Philippine Army's lack of training, equipment, and their almost immediate collapse. Skillfully, Blackburn was able to escape from the Japanese. The quick collapse of the Filipino Regular Army forces propelled Blackburn into beginning a fight "unconventionally."

The account focuses heavily on the unconventional GW fight for the majority of the rest of the book. After realizing the initial superiority of the Japanese Army, the U.S. command gave 1LT Blackburn and MAJ Volckmann orders to peacefully surrender; however, they did not! (Hence the title of the later Hollywood account of this book "Surrender - Hell!") Instead they immediately contacted the higher Philippine Army command to assist them in their resistance. They went on to further recommend the formation of an insurgency and the creation of a guerilla army. The Philippine Command agreed, however they were not up to the task. They partially mobilized and joined the resistance but were extremely limited in most areas. They also fell prey to Japanese fear tactics and extreme torture methods employed on all Filipinos' creating ANY form of resistance. 1LT Blackburn and MAJ Volckmann took on the task to create the insurgency and the guerilla army.

The author, Philip Harkin, skillfully used Blackburn's memoirs and records to re-create the portrayal of his guerilla warfare training and operations in the Philippines. 1LT Blackburn, along with MAJ Volckmann, took



on, of their own accord, the task to build this force. The book shows the difficulty that they encountered at every step, and in every sense. Their frustration was apparent, even in the initial screening of the varied groups of Filipinos. Some were ready to fight, but many wanted to just sit by and watch and remain uncommitted to either side. The uncommitted ones became known as the “fence-sitters.” Next, and most importantly, the book brings out the importance for them to meld with and gain the Filipinos’ trust. Although extremely difficult, Blackburn employed local tribes to include Ilocano and Fuego native headhunters to create the bulk of his guerilla army, hence the name “Blackburn’s Headhunters.” The success of the native forces, along with his own survival, was in direct proportion to the degree that he integrated and empowered them.

Throughout the book, Blackburn’s accounts showed the brutal Japanese treatment of the Filipinos who resisted, and often equally brutal treatment even to those who did not resist. He described methods of torture that without question equal and top the most heinous and evil anywhere, at any time. The fact that the guerilla force kept going in the face of the risk of torture showed the level of trust that Blackburn had earned. Blackburn’s effectiveness, integrity, and leadership grew throughout the continued training and employment of the native guerilla army.

The medical significance of this book is minimal. There were plenty of medical issues and concerns in the Philippines during WW II, but most of the medical challenges and issues have been better documented and written about elsewhere. In short, there was practically no medical capability present in the Philippine Army, and the U.S. Army medical capability was very limited outside of the major cities and few major military bases. Among the biggest medical problem in the Philippines was dysentery. It ran rampant in many areas of the Philippines – especially in the central jungle areas, which was where Blackburn spent most of his time training his force. The author also refers often to the many other intestinal tract diseases and parasites that produced a drain on his men, to include nausea, diarrhea, fever, and dehydration. Mosquitoes and leeches added significantly to infection, malaria, fever, and general extreme discomfort. Quinine, if they could get it, was referenced as the cure for just about everything. According to Blackburn, it helped some, but nowhere near enough.

The SOF significance of Don Blackburn is extensive. Throughout Don Blackburn’s career he continued to contribute and build on the lessons and accomplishments from the Philippines. Shortly after his successful tour in the Philippines, Blackburn was assigned to Military Advisory Group – South Vietnam and did a great deal of work with the South Vietnamese Army in the Mekong Delta area. Shortly afterward, COL Blackburn was given command of the 77th Special Forces Group (soon to become 7th Special Forces Group) at Fort Bragg, NC, where he immediately established training designed to enable his ODAs to provide infantry training to foreign indigenous personnel. COL Blackburn was responsible for sending the first group of ODAs into Laos, under the famed LTC Arthur D. “Bull” Simons, to assist the Laotian Government in training their Army. This program became an in country preparation for Special Forces deploying to Southeast Asia and a model for the training program given to the Army of the Republic of Vietnam (ARVN).

After his command of the 77th SFG (A), Blackburn was instrumental in growing Special Forces and in further developing their employment and training. He worked closely with famed BG William Yarborough at the Special Warfare Center and was significant in further improving failed intelligence operations in Vietnam. Out of Blackburn’s increased efforts in Vietnam came the development of the critically needed Military Assistance Command Vietnam – Studies and Observations Group (MACV-SOG), of which Blackburn became the second commander. The intelligence benefits of MACV-SOG were critical to the successes in Vietnam – when they were acted upon. COL Blackburn was soon appointed to BG and was the designer and recruiter for the famous Son Tay Prison Raid in which COL Bull Simons led the forces into the compound to rescue 70 American prisoners held hostage. BG Blackburn continued to contribute to the empowerment of Special Forces at the highest levels of the DOD and he is considered to be one of the founders, if not “the” founder, of Army Special Forces today. His experience bears relevance also to the ongoing missions of today.

BG (Retired) Blackburn passed away in 2008 in his home in Sarasota, Florida. He epitomized contribution and service and made an enormous difference for both Special Forces and for this country overall. He is greatly missed but his spirit lives on in Special Forces.

See also:

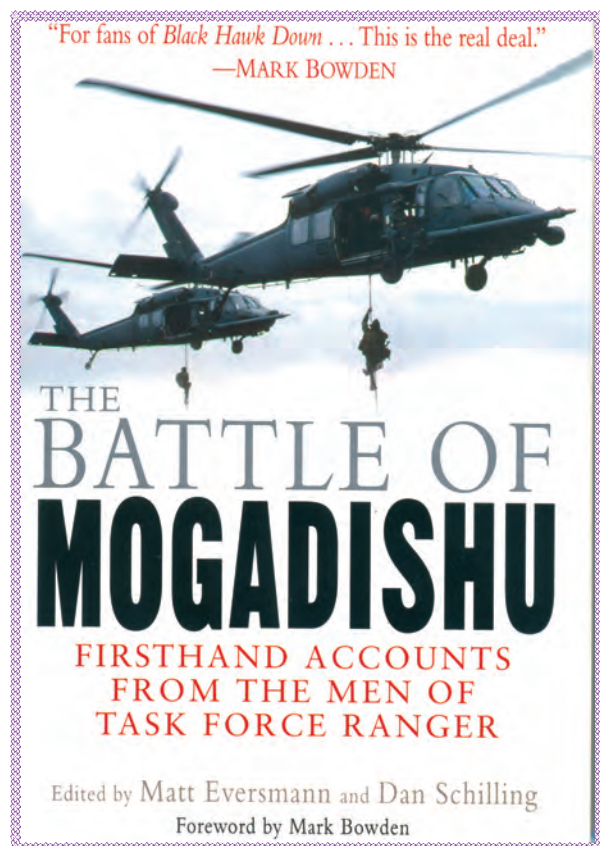
<http://www.arlingtoncemetery.net/ddblackburn.htm>

## The Battle of Mogadishu: Firsthand Accounts from the Men of Task Force Ranger

Edited by Matt Eversmann and Dan Schilling. Forward by Mark Bowden New York: Presidio Press. 2005.

ISBN: 0-345-45966-0.

Review by LTC Craig A. Myatt



It was a difficult way to earn military pay on a couple of hard days in Somalia. *The Battle of Mogadishu: Firsthand Accounts from the Men of Task Force Ranger*, edited by Eversmann and Schilling, is a telling account of six different descriptions of one single battle that many know from Mark Bowden's *Black Hawk Down: A Story of Modern War*. Six men share their personal thoughts on a mission planned initially for straightforward, standard operating procedures, to be executed in the Horn of Africa. At the time, the October 1993 Mogadishu mission became the fiercest ground combat that the U.S. had fought since the Tet Offensive in Vietnam in 1968.

What draws the reader into the realities of modern day war in Eversmann's and Schilling's work in a manner distinct from Bowden's literary and cinematic accounts? The draw is the dialogue and thoughts of warriors written by warriors. One of the strengths of Bowden's literary exploit, not necessarily reflected in its cinematic portrayal, is an account of Somali viewpoints throughout the Battle of Mogadishu. What did the average Somali think about the American threat and carnage on his, or her, streets? What did the Osama Bin Laden-trained Somali devotee of Mohammad Farrah Aidid think throughout the battle? Bowden unveils this. Eversmann and Schilling do not. They disregard the thoughts of the Somalis, and focus on their own tactics, thoughts, perceptions, and feelings in battle. The battle-smeared perspectives of six highly trained United States warriors caught in more of a fight than what they planned reveals the absolute sense of courage required in war.

Six men with six different accounts of one battle becomes a streamlined series of American perspectives on how one battle could have been, should have been, and ultimately was fought. The lessons learned in the series of accounts are important, but more important is the breadth and depth of thought that led the United States to victory through the chaos of battle. Did they plan? Of course, they planned. Their planning, nonetheless, led to what all careful planners plan to avoid — the unexpected. Confronted by the unexpected, did they pray? Yes. Were they profane? Yes. Did they question their own actions or the actions of others? Yes. Did they feel an impending sense of doom? Yes. Did they quit? No.

Eversmann's and Schilling's text is a story of how six men displayed the courage not to quit based on the expert level of training they went through prior to battle and their sense of commitment to their buddies, unit, family, and nation. Each man showed *ne plus ultra* determination in their heated confrontation with Somali fighters loyal to Mohammed Farrah Aidid. The Somali fighters generated a formidable force employing methods to shoot down helicopters and go face-to-face in

combat against anything and anyone, especially Americans. The Somali fighters battled with no sense of letting down. The precise attacks from Somali fighters, followed by relatively well-coordinated ambushes, incorporated tactics that had proven successful in Soviet-Afghan warfare in the 1980s.

In Mogadishu on October 3, 1993, United States Army Rangers and Delta Force teams in Operation Gothic Serpent started a relatively routine mission to capture tier one personalities serving under the Somali warlord Mohammed Farrah Aidid. Staff Sergeant Matt Eversmann, a chalk leader, was with the first group of Rangers who fast roped from one of the Black Hawk helicopters involved in the mission. He was the last to exit his aircraft. By the time he descended down the rope, Somali bullets had already struck one of his men.

Fast roping into the battle and establishing immediate casualty collection points (CCPs) became a prominent theme throughout the six chapter text. Fast roping is always potentially dangerous. In Mogadishu that day, the danger of fast roping exceeded its potential. Early in the course of the battle, the need to establish CCPs rapidly transitioned into the need to maintain CCPs.

A straightforward mission chaotically unraveled into a death-defying rescue operation. Sergeant Raleigh Cash did not enter the raging battle by fast roping. He advanced into battle in an eight-vehicle ground convoy sent to rescue his besieged buddies. Cash became the primary forward observer charged with rescuing those who crashed in the first downed Black Hawk.

In Special Operations Forces, if rank is less important than tactical proficiency, knowledge, and the will to overcome challenges, then it is no surprise that a Specialist (E-4) uttered the famed "Black Hawk Down" call in battle. Specialist Mike Kurth, a radio and telephone operator, former infantryman, and native of Texas, was on the radio as soon as he saw the first Black Hawk go down: "All stations be advised – we have a bird down, we have a Black Hawk down." Thinking clearly, Kurth made initial radio contact to let everyone know what had just happened. He felt that the sooner his higher command knew about it, the better. Radio contact then became more than intense. It became frantic. Everybody (friendly and foe) in the vicinity of the battle wanted to find the crash site.

By the time Sergeant John Belman engaged in the battle he had fast roped into the biggest firefight of the battle and his helicopter had already been hit with a rocket propelled grenade (RPG). As he slid off the rope, with approximately a 40-foot drop, he hit the ground hard and thought it a big mistake to use Black Hawk helicopters to provide sniper cover. Mistake, or not, his role on the Combat Search and Rescue (CSAR) team meant he had a job to

do. But his thoughts about the use of Black Hawk helicopters to provide sniper cover could not be avoided. A Delta sniper who had been on the first Black Hawk downed lay on the ground disoriented with severe facial injuries. Belman aided the sniper, but ran out of ammunition very quickly. In the course of the battle, existential perspectives overwhelmed him as he thought that if he were killed, he did not want anyone to have to die to protect his dead body. After making way to a CCP, he grabbed additional ammunition and made sure he stayed alive for the fight.

Pararescueman (PJ) Tim Wilkinson served as one of the Air Force PJs who conserved life for many of his buddies in battle under intense Somali fire. He claims that during his insertion he saw more RPGs streaking through the sky than he had ever seen on any of his previous missions. He knew the men on the ground were locked in mortal combat. His job was to maintain life at the established CCPs and facilitate medical evacuation. Wilkinson vividly recalls saying a silent prayer before his insertion. His fast rope experience became intensely dangerous, as it had been for all the others, but more so in his case because he shouldered the added weight of approximately 90 pounds of equipment and medical supplies. Wilkinson's recollections demonstrate the scope of mental focus balanced by creative distractions. "The mind is a funny thing," he states. All he could think about in one of the most chaotic combat scenarios he faced was a scene from the movie *The Jerk* starring Steve Martin. With so much information being directed at him all at once, and chaos all around, he found thoughts of Martin's role in *The Jerk* to be enough of a creative distraction for him to remain in touch with his battlefield reality but not consumed by it.

Staff Sergeant Dan (Dano) Schilling, an Air Force combat controller responsible for directing close air support from rotary wing aircraft, made several forays by ground into battle to rescue his buddies. The designated "medic" on his team, not only did he plan key parts of the mission as a combat controller, but also he rendered life saving techniques and procedures that spared many others in battle. His drive and commitment literally made him the last out among the six contributing warriors in the book and in the battle itself. He claimed that in the Battle of Mogadishu, the sensation for him was different than any he had experienced before on other missions. He could feel the difference, but could not define it. When he and the others finally made it out to a safe zone, his most poignant thoughts were of his friends, alive and dead.

In a two-day battle in which 18 United States servicemembers died and 73 were wounded, the men of



Task Force Ranger encountered enemy tactics, techniques, and procedures that served as a forerunner of future threats in Southwest Asia. Task Force Ranger included not only Ranger and Delta Force teams, but also Air Force Pararescue and Combat Controller teams, Navy SEAL Operators, and the 160th Special Operations Aviation Regiment. The task force configuration used in Operation Gothic Serpent is still common among those used in support of overseas contingency operations today.

In this book, Eversmann and Schilling revisit a seminal military mission that reflects hard lessons

learned from the experiences of battle against a formidable opponent. Their literary contribution is an excellent read for both warriors and historians. Eversmann and Schilling share an accurate depiction of a battle that taxed the thoughts, perceptions, feelings, and perspectives on life for them and four of their friends: Cash, Kurth, Belman, and Wilkinson. I highly recommend the work for anyone engaged in the new norm of modern, 21st century warfare, especially for those working in Special Operations.



# From the Command Surgeon



Virgil "Tom" Deal, MD  
COL, USA  
Command Surgeon  
HQ USSOCOM



Well, to say that I'm a bit awed would be an exercise in understatement. The contributions of the SOCOM Surgeon's Office over that last eight years have been highly significant. The improvement in the diagnostic tools and the effectiveness of an increased array of therapeutic interventions available to the Special Operations medical personnel throughout the prosecution of the conflicts at hand has been huge. I really have to salute the surgeons, senior enlisted medical advisors (SEMA's), and staff that have stood the watch in Tampa and beyond since 9/11.

Now that the music has stopped for this summer's round of medical musical chairs, I am astonished to find myself standing beside the one that oughta be clearly labeled "Rocky". Please join me in saluting one of our finest as he heads to the other side of MacDill, AFB – and the other side of the planet – to take the reins as the SOCCENT Surgeon. Stay safe, Rocky! Don't stray too far from the STU for those times when I and the rest of us need to ask the tough questions!

Our year ahead certainly promises to be interesting. The Command's awareness of the issues atten-

dant to the impact of stress on the force continues to be keen. LTC Craig Myatt chaired a two-day meeting of the Resilience Enterprise Working Group this month and will be working with you and your reps to delineate best practices from what you guys are already doing to mitigate the effects of the stress of eight-plus years of near continuous deployments.

Congratulations are certainly in order to Jim Lorraine, the first Director of the SOCOM Care Coalition, who's been called upon by the Chairman to act as his advisor on issues related to casualty care. Jim's contributions on the long-term care of our SOF sick and wounded has been a new chapter in how we approach the entire constellation of issues when providing for the wounded and dealing with the disability process.

We're looking forward to next month's Advanced Technologies meeting in St Petersburg. That meeting and your continued lessons learned input on what widgets are working and which ones aren't provides much of the basis for a continued smooth acquisition process. Please keep the critiques coming in. See you at the SOMA Conference, 12-15 Dec!



Peter J. Benson, MD  
COL, USA  
Command Surgeon

# USASOC



The summer always brings personnel changes to the medical community, and Fort Bragg is no exception. I have left the U.S. Army Special Forces Command (Airborne), Command Surgeon position in the able hands of LTC Andrew (Drew) Landers, formerly the 7th Special Forces Group Surgeon. I have replaced COL Tom Deal as the U.S. Army Special Operations Command (USASOC), Command Surgeon. This was a somewhat precipitous move, but hopefully all the pieces will fall into place as we proceed about the business of supporting the Command and subordinate units in the provision of Health Service Support (HSS). I want to thank all the medical providers in the Special Forces Regiment for their support and input as the Special Forces Command Surgeon's Office was established and found its way. I have every confidence that LTC Landers will do an outstanding job in continuing to build the office and supporting the Regiment as the Surgeon's Office matures.

As the new USASOC Command Surgeon, I feel privileged to be chosen to follow such august gentlemen as COL Farr, COL Diamond, and COL Deal. I hope to validate the trust and confidence of the Command in having been chosen. The Surgeon's Office will continue to be the advocate for providing the right personnel, equipment, and training to medically enable the force. I plan to take a look at some new, as well as some old, initiatives that will have long-range effects on the medical part of the force. This includes the creation of an organic US-

ASOC organic Forward Surgical Resuscitative Element (FSRE) capability, an Female Treatment Team capability, strategies for critical care CASEVAC, an advanced clinical training course for Special Forces Medical Sergeants, the establishment of additional medical Modified Table of Organization & Equipment (MTOE) positions in the 4th PSYOP Group, among others. Another initiative for USASOC has been the recent approval for selected special staff officers to attend the 18A Special Forces Qualification Course. This program, recently approved by MG Csrnko, the Commanding General of the John F. Kennedy Special Warfare Center and School, will once again allow selected medical corps and medical specialist corps officers the opportunity to become Special Forces qualified. Although not granted the 18A MOS, this will provide a solid core of foreign internal defense (FID) and unconventional warfare (UW) trained providers to be the advocates for HSS as it relates to Special Forces Operations. This pilot program will fix a 16-year hiatus in training SF qualified medical officers.

I would like to commend all the providers at all levels within USASOC for doing their very best to provide the best medical support possible to their units. As forces prepare to conduct the ongoing operations of the Nation's persisting engagement, I encourage all to remain diligent and steadfast in their roles as providers. Continue to maintain your skills and equipment, train your peers and subordinates and remain one step ahead of the threat.



## COMPONENT SURGEON



Bart Iddins, MD  
Brig Gen (S), USAF  
Command Surgeon

This article continues with the discussion of AFSOC Surgeon's priorities and focuses on **Priority 4:** Develop an AFSOC healthcare engagement strategy and capability that supports counterinsurgency (COIN), irregular warfare (IW), foreign internal defense (FID), security, stability, transition, reconstruction (SSTR), disaster response, and humanitarian operations (see JSOM, Winter 2009 for complete priority list; JSOM's Spring 2009 edition for detailed review of Priorities 1 through 3).

As evidenced by the lessons of history, the contemporary conflicts in Iraq and Afghanistan, and from situations such as those now unfolding in Pakistan, it is clear that the United States of America must maintain a robust and viable capability for conducting COIN, IW, SSTR, disaster response, and humanitarian operations. If, despite the aforementioned examples, one is still unconvinced of this absolute requirement, one only needs to examine Brookings Institution's *Index of State Weakness in the Developing World*. This index factors economic, political, security, social welfare, and per capita gross national income (GNI) data from 141 states into an overall weakness score of 0.00 (worst) to 10.00 (best). According to this methodology, the five weakest states are Somalia, Afghanistan, Democratic Republic of the Congo, Iraq, and Burundi. Furthermore, 56 of the 141 states are listed in the bottom two quintiles and are at significant risk for unrest, instability, and potential collapse.

Failed states are unequivocally not in the national interest of the United States, nor in the national interest of any other developed nation. While the previous statement is intuitively obvious, its solution is more elusive, but illustrates the absolute requirement for forces that can effectively apply "soft power with a hard edge."

## AFSOC



This description by Admiral Eric Olson regarding one of the many capabilities SOF contributes to national defense also perfectly highlights an underutilized SOF medical capability. While SOF medical forces serve in traditional supportive and enabling roles, they can equally deliver an unrivaled form of "soft power with a hard edge" in support of COIN, IW, FID, and SSTR operations. Additionally, senior leadership, as demonstrated by the following quotes, recognizes and espouses the imperative to embrace and deliver "soft power with a hard edge."

*"The Nation is at war...whether our contribution is in irregular warfare in Iraq and Afghanistan, the fight to save lives through humanitarian relief operations, or deterrence and dissuasion of potential adversaries, the Air Force is a key contributor to the national defense of America."*

USAF Chief of Staff, General Norton Schwartz, 2008

*"...the kinds of [security] challenges America will face...from global terrorism to ethnic conflicts cannot be overcome by traditional military means alone. Conflict will be...political in nature and will require the integration of all elements of national power."*

*"These new realities...should be reflected in our training and doctrine. The Air Force will be...called on to conduct civil-military or humanitarian operations with interagency and non-governmental partners, and deal directly with local populations."*

Secretary of Defense Robert Gates, AWC speech, 2008

Numerous military and civilian governmental/non-governmental organizations are heavily involved in healthcare engagement activities. The vast majority of these organizations, to include SOF units, are doing heroic, often unheralded work in demanding and dangerous environments in many of the world's developing nations, trouble spots, and war zones; however, in spite of these herculean efforts and notwithstanding the best of intentions, much of this critically important work is being conducted without an overarching strategy. As a result, many organizations conducting well-intended healthcare engagement missions habitually fail to adequately coordinate and integrate their efforts. Predictably, this lack of an overarching strategy and failure to coordinate/integrate activities further cascades into a loss of unity of effort and potential synergy, becomes counterproductive, and may, in fact, ultimately undermine the desired effect of the healthcare engagement mission. In response, AFSOC has created the USAF's first and only IW/Healthcare Engagement Division. This division (AFSOC/SGK), under the leadership of Lt Col (Dr) Mike Hartzell, a veterinarian with a master's degree in Public Health, is staffed by a medical planner, international health specialist (IHS), and a senior non-commissioned officer. The division is charged with the following:

- Organize, train, and equip (OT&E) AFSOC medical forces for healthcare engagement in support of COIN, FID, IW, SSTR, disaster response, and humanitarian operations
- Develop overarching healthcare engagement strategy, doctrine, tactics, techniques, and procedures (TTP)
- Plan, coordinate, deconflict, and integrate healthcare engagement activities
- Serve as subject matter experts; provide healthcare engagement, COIN, FID, IW, SSTR, disaster response, and humanitarian operations' expertise

In short, AFSOC's IW/Healthcare Engagement Division will significantly increase AFSOC medical support to COIN, FID, IW, SSTR, disaster response, and humanitarian operations. Furthermore, the IW/Healthcare Engagement Division will ensure that the AFSOC healthcare engagement is conducted in accordance with a strategic plan designed to create effects that directly support overall theater campaign initiatives and theater engagement strategy.



The logo for the Component Surgeon is a dark blue rectangular banner with a metallic, three-dimensional appearance. It features the words "COMPONENT SURGEON" in a bold, white, sans-serif font. The banner is set against a light blue circular background.

# NAVSPECWARCOM



Jay Sourbeer, MD  
CAPT, USN  
Command Surgeon



In my capacity as the Force Medical Officer of Naval Special Warfare, this is my final letter to the Journal of Special Operations Medicine. As a deep sea diver who came to Special Operations as a tech from another community and who eventually returned as Force Medical Officer, I've brought a different view to the SOF world than my conventional career Special Operations colleagues. Whether it is Master Chief Mercer posing as a diver, COL Rocky Farr putting a ruler to a stack of journals, or the combined efforts of all of you to improve forward surgical care and bring professionalism to human performance, I want to thank you for your contributions to several highly enjoyable years of service.

In particular I would like to thank COL Rocky Farr for his practical leadership and advice, and especially for sharing his rich insights into Special Operations over the years. CAPT Frank Butler, his predecessor, left important lasting contributions that I greatly appreciate as well. I treasure my association with the next generation of Army, Air Force, and Marine Special Operations leaders. It is a great joy to see COL Jim

Czarnik, COL Rob Lutz, COL Ric Ong, and COL Mark Erwin serving the nation professionally. There are many more – I cannot name all, but I will always appreciate the work of those who set interests aside in service of our nation's ideals as embodied in the Constitution.

I hope you will extend a warm welcome to my successor at WARCOM Medical, CAPT Gary Gluck. He is board certified in emergency medicine and brings diverse experience in Special Operations, having served previously at the Naval Special Warfare Center and most recently at SDVT-1. As with my earlier allusion to colleagues in the other services, it is a great satisfaction to know that I am putting a treasured responsibility in such able hands.

I am being assigned as a student to the Naval War College, Newport, Rhode Island, to add further to my professional education. Although I am looking forward to the exciting challenges ahead, I sincerely hope to keep the friendships I have made in Special Operations. It has been an honor to serve with you.

Thank you.



## COMPONENT SURGEON



Anthony M. Griffay, MD  
CAPT, USN  
Command Surgeon

Marine Corps Special Operations Command (MARSOC) and MARSOC Medical continue to change and evolve. Not only are we in the beginnings of a major change in medical personnel due to end of tour orders, but MARSOC has evolved from two operational battalions and an Advisor Group into three battalions and a Regimental Headquarters. At the same time MARSOC is continuing to deploy teams down range and plan for an increased presence and responsibility in higher levels of intra-theater command and control.

My filling the large shoes left by CAPT McCartney marks the beginning of a 75% turn-over in the medical leadership within MARSOC. As with all military units, turnover is inevitable, and to those moving on I would like to express my sincere admiration and gratitude. This departing group of professionals helped build MARSOC Medical from nothing, into an organization capable of supporting teams around the world. Their experience and dedication will be truly missed. For the incoming personnel, this is an exciting time in MARSOC as it transitions from growing and organizing to defining its future in the Special Operations community. From developing the culturally-specific medical training needed for foreign internal defense (FID), to supporting and training theater Special Operations Surgical Teams required to support direct action operations, MARSOC Medical will evolve and grow to meet any needs.

MARSOC has recently reorganized our organizational structure into a Regimental Headquarters and three battalions, adopting a more standard military formation and standardizing the capabilities of the deployable elements. Now all three battalions train to operate across the

## MARSOC



full spectrum of special operations, emphasizing FID and special reconnaissance (SR) while retaining a robust direct action (DA) skill set. With this, the medical support section and the medical capabilities will need to grow and expand. This will be our biggest challenge! To train and support MARSOC in the future we will need to work, coordinate and train with our fellow components both within United States Special Operations Command (USSOCOM) and throughout the “big” Navy. Like all of SOF, MARSOC is small and exists in a financial reality which will never allow us to own all of the assets that we need. However, regardless of whether a medical element is SOF-owned or SOF-capable, we must take an active role in defining, equipping, training, and preparing it to support our SOF missions.

This reorganization will not only allow MARSOC to provide better command and control over an increasing number of teams but also provide the higher level headquarters elements it needs. These elements will be the core of Special Operations Task Forces (SOTFs) and Coalition Joint Special Operations Task Forces (CJSOTFs) as MARSOC begins to plan for and increase its role at the SOF higher headquarters within the Central Command Area of Operations (AOR) and throughout the world.

As I already mentioned, this is an exciting time to be part of MARSOC and USSOCOM. I am looking forward to my time here and hope to meet and work with as many of you within the SOF community as possible. Please feel free to contact me at any time if there is something I may be able to assist with. COMM 910-451-3462 DSN 751-3462 or [anthony.griffay@usmc.mil](mailto:anthony.griffay@usmc.mil) SIPR [anthony.griffay@marsoc.socom.smil.mil](mailto:anthony.griffay@marsoc.socom.smil.mil).



Warner D. "Rocky" Farr, MD  
COL USA  
SOCCENT Surgeon

## SOCCENT



I am writing this on USSOCOM's nickel in late June before I go on PCS leave for my strenuous PCS of five whole miles within MacDill AFB, to SOCCENT Headquarters. I would like to thank all who have helped me in getting done all that I have gotten done in my three years at USSOCOM. As my CSM back in 1973 in Germany used to say, "And you know who you are!" I went over 42 years active service on 23 April 2009. It is good to still be upright and breathing and contributing to the war effort.

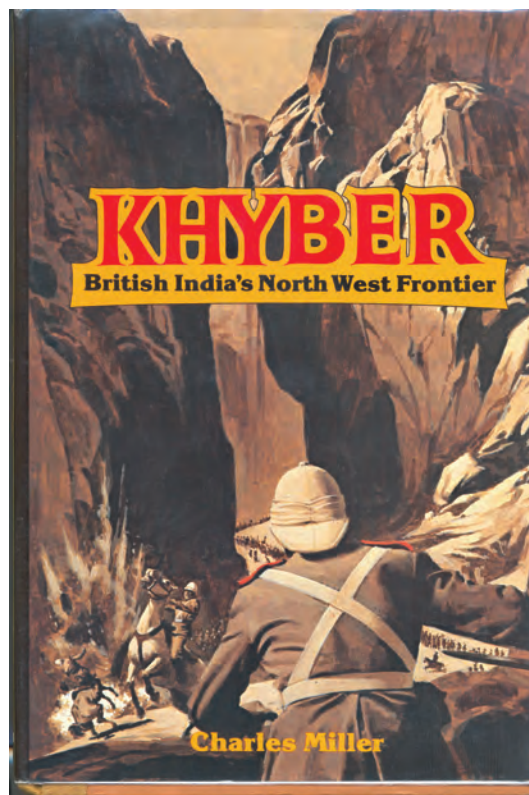
We have had some successes at USSOCOM in the last three years, much of it on the backs of my predecessors who set me up for success. The *Journal of Special Operations Medicine* (JSOM) is bigger and better and the pocket size *Advanced Tactical Provider Annual Training Supplement* seems to be well received. The Advanced Practitioner Card now has reciprocity with several other registries. The Tactical Combat Casualty Care Acquisition program is proceeding and medics are getting more of what they need as we branch into extraction and surgical kits. The Theater Special Operations Command Surgeon slots are in place and filled – one by ME, quite unexpectedly. MC Mercer's Warrior Rehabilitation Performance Center Program has funding and is proceeding. The program is the key capstone to preservation of human capital! The Level-2 surgical piece of medical support has been approved as a concept, now we just have to figure how to resource it. Colonel Deal, "Post! Sir, your ball."

I plan to continue to contribute to the JSOM as the SOCCENT Surgeon but probably not much of an operational nature, security and all. Therefore, this quarter's entry will be yet another book review.

### **Khyber, British India's North West Frontier: The Story of an Imperial Migraine**

Charles Miller

New York, New York: Macmillan and Company, 1977.  
393 pages. ISBN-10: 0025848607; ISBN-13: 978-0025848603



This is a great read that speaks directly to today's ongoing events. This book was published way before 9/11. I found it and read it again after 9/11. It is part of the answer to the question of why bin Laden is still at large. No one has ever really controlled that border area; not Alexander the Great, the Arabs, the British, not the Afghans, the Persians, the Indians, the Sikhs, nor the Russians, nor even the tribes themselves. This book should be a must read for every GWOT leader in Afghanistan. It explains the issue of the Afghans not tolerating an occupying military force well at all. It is a well-written work covering both the political and the strategic/tactical episodes, all of which shaped the British in their attempts to conquer Afghanistan for over 100 years and in their attempts to control the Northwest Frontier. It actually has a large amount of medicine in it, telling several stories on early missionary efforts – most were killed. Several British Army unit surgeons play prominent parts in it including one, Surgeon William Brydon, who becomes the only escapee of an entire British Army, wiped out to the next to the last man, with

him being the only man to survive the retreat to Pakistan and to tell the tale. He later goes on to fight in the "Second Afghan War," the British having not learned anything from the first one!

This book is the very best of popular history. It is a book that is colorful, well written, and flows nicely. It has good references but not a large number of footnotes. The bibliography itself is interesting to read to see such works as "*Cabool: A Personal Narrative of a Journey to, and Residence in That City in the Years 1936, 7, and 8.*" With the new interests in Afghanistan, Pakistan, and currently the entire Northwest Frontier area, this book, written in 1977, is suddenly timely! It would be nice to see an updated edition including the Soviet debacle, the rise, and destruction of the Taliban, and the American presence in Afghanistan. Copies are findable on Amazon and the other used-books sites. It is always interesting to read a book about the British "colonial" experiences, especially when they lose, as they seldom did in the "Colonial Wars." Just like in Basra, they were there before us.







Frank J. Newton, MD  
COL USA  
Command Surgeon

# SOC PAC



## FORCE HEALTH PROTECTION (FHP) AND A REVIEW OF COUNTERMEASURES TO REDUCE THE THREAT OF RABIES TO U.S. MILITARY FORCES

Our commanders have come to expect that they will have a healthy, fit force that is prepared to execute any mission, at any time, and under any conditions. Surgeons, their staffs, and a robust medical network rapidly conveys information about disease outbreaks and emerging threats (like the H1N1 flu virus), better than ever in our history to counter medical threats to U.S. military forces..

Looking over the specific medical threats in South and SE Asia, with rare exception, our troops are immunized against many of the disease threats encountered. Two notable exceptions, which do not have immunizations available for primary prevention are some diarrheal illnesses and Dengue. In both cases, personal protective measures, good discipline, and command emphasis are required to maintain fitness to complete the mission and redeploy in good health.

Rabies, a medical threat frequently encountered by SOF in the developing countries where they are employed, requires constant vigilance and command emphasis. The virus is transmitted by the saliva of infected mammals through bite wounds, open cuts in skin, and when there is mucous membrane contact, with saliva or other infectious tissue such as brain. In the U.S., wildlife (especially raccoons, skunks, and bats) are responsible for most human and domestic animal infections. In most of the world where rabies is enzootic, including most of Asia, Latin America, and Africa, dogs remain the major source of rabies transmission.

SOF personnel receive primary or pre-exposure vaccination for rabies. This is an important FHP measure, considering that infection with rabies is universally fatal, and that SOF operates in austere settings where there is a high prevalence of rabies, and medical support, including biologics (vaccine and RIG) may not be immediately available. Many of the support personnel that deploy to augment our task forces have not received rabies vaccination. Their exposure to rabid animals (or even *suspected* rabid animals) is a medical urgency.

Recently, such an exposure occurred in the Philippines, where the incidence of rabies is ranked number six in the world. The servicemember had been playing with a six-month-old dog outside of a military camp when the unprovoked dog bit the Soldier on the hand, causing a full-thickness injury. The dog was quarantined, and was found dead in his kennel less than 24 hours later. Brain fluorescence for the rabies antibody was positive.

Treatment for an animal bite includes immediate cleansing of the wound with soap and water, or preferably povidone-iodine (betadine).<sup>\*</sup> For **previously vaccinated** individuals, post-exposure treatment consists of two IM doses of rabies vaccine, (1.0ml each) , into the deltoid muscle. The first is given as soon as possible after exposure and the second is given three days later. **Unvaccinated individuals** are given a five shot series on day zero, three, seven, fourteen

and twenty-eight. Rabies immune globulin (RIG) is administered only once, to previously unvaccinated individuals, and should be administered as soon as possible after exposure.

The dog or cat that bit the servicemember should be quarantined for up to ten days of observation to see if they will exhibit signs of rabies. If the animal exhibits signs of rabies, then it should be euthanized by the closest military veterinary treatment facility or authorized contract agency, and the head submitted for definitive testing. Any animal other than a cat or dog that bites a servicemember will be immediately euthanized and the head submitted for testing. The preferred method of euthanasia is an injection of euthanasia solution. If euthanasia solution is unavailable, then any approved method that preserves the brain should be used.

A discussion of rabies testing submission procedures can be found in the Command Veterinarian column.

Link to CDC, Human rabies prevention-U.S.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5703a1.htm>.

\*Editor's note: The 5th Edition of Auerbach's *Wilderness Medicine* advises (p 1218) us not to trust reports of vaccination of dogs in foreign countries as ... "fatal rabies has been reported in U.S. citizens and in others who were bitten by "vaccinated" dogs in developing countries." On this same page, the former Chief of the Viral and Rickettsial Zoonoses Branch of the CDC advises us that "... local treatment [i.e., cleansing wound with soap and water] is perhaps the single most effective means of preventing rabies."

The following table by the WHO provides current guidelines for specific post-exposure treatment for rabies.			
Nature of exposure	Status of biting animal (irrespective of any earlier vaccination)		Recommended treatment
	At time of exposure	During next 10 days <sup>a</sup>	
Contact, but no lesions; indirect contact; non-contact	Healthy		None
	Suspected as rabid <sup>b</sup>	Healthy	None
		Rabid	None
Licks on the skin; scratches or abrasions; Minor bites (on covered areas of arms, trunk and legs)	Healthy	Healthy	None
		Rabid	Start vaccination schedule <sup>c</sup>
	Suspected as rabid <sup>b</sup>	Healthy	Start vaccination schedule; stop treatment if animal remains healthy for five days <sup>a, d</sup>
		Rabid	Start vaccination schedule; upon positive diagnosis, complete the course of vaccine
	Rabid; wild animal <sup>e</sup> or animal unavailable for observation		Give complete course of vaccination
Licks of mucosa; major bites (multiple or on face, head, neck or finger)	Suspect <sup>b</sup> or confirmed rabid domestic or wild <sup>e</sup> animal, or animal unavailable for observation.		Immunoglobulin <sup>f</sup> and vaccine. Stop treatment only in the case of domestic animal under observation <sup>d</sup> that remains healthy for five days.
<b>Notes</b> a. This observation period applies only to dogs and cats. Other domestic and wild animals suspected as rabid should be killed and examined using the fluorescent antibody techniques. b. All unprovoked bites in endemic areas should be considered suspect unless proved negative by laboratory examination of the animal's brain. c. During the usual period of 10 days, begin treatment with vaccine at first sign of rabies in a dog or cat that has bitten someone. The symptomatic animal should be killed immediately and examined using the fluorescent antibody technique. d. Or if the animal's brain is found to be negative by fluorescent antibody examination. e. In general, exposure to rodents, rabbits and hares seldom, if ever, requires specific anti-rabies treatment. f. Rabies immune globulin (RIG) is administered only once to previously unvaccinated individuals. It should be administered as soon as possible after exposure.			
<b>Reference</b> Human Rabies Prevention U.S., 1999 Recommendations of the Advisory Committee on Immunization Practices.			

## Special Forces Surgeon



LTC Andrew Landers, MD  
COL, USA  
Command Surgeon



## USASFC



I would like to introduce myself as the new US-ASFC(A) Command Surgeon – having made the small leap across the street from 7th SFG(A). I would also like to thank COL Pete Benson for giving me the opportunity to continue the great works that he started during his tenure with USASFC(A).

The Surgeon's Office is running on all cylinders with my assigned friends: MSG Oscar Ware, Senior Medical Enlisted Advisor, leading the way for all 18D, SAV, and CIP issues, and CPT Chad Vermillion, Deputy Surgeon, in charge of medical operations and logistics. There are two new additions to the office: SFC Curt Unterreiner (MED TNG NCO) and SFC Fred Ziems (MED OPS NCO). These are dynamic times, and the need for Special Forces Soldiers is on the rise. This means that flexibility, adaptability, and planning will be the keys to our success.

There are a few items that I would like to address from this office. First, the proposed BAND V growth has been approved by USASOC and is currently being reviewed at USSOCOM. It includes the expansion of a medical company consisting of 36 personnel for each Group. Hopefully, we will be able to push this all the way and gain the medical flexibility and staffing that is needed at the Group level. Second, as the need for Special Operations Forces increases in support of overseas contingency operations, you need to look hard at the Joint Manning Document (JMD) of the Task Force, available resources in theater, and what you will need to provide Health Service Support (HSS) to your Task

Force. Remember, if you need a capability that US-ASOC cannot resource internally, the request for forces (RFF) must be submitted from theater. Make sure that you are talking with your counterparts for the latest and greatest. We are standing by to assist you, so please, do not hesitate to contact us. If we do not know what you need, we cannot help you. Third, it is extremely important to collect and articulate lessons learned from training and deployments. We need to stay ahead of the curve; we cannot afford to practice "status quo" medicine. No one likes to write reports, but it can make a real difference on the future of our battlefield. Fourth, as we look to the future with the SOMA Conference around the corner, please contact me or MSG Ware with your suggestions on topics that you would like covered in the SF breakout sections. The goal is to make it more educational for the SF medics and provide the most relevant, and up-to-date information. Lastly, the USASFC(A) Surgeon's Office will continue to handle professional assignments and staffing of the Groups. We are working on FY10 slating, so now is the time to contact us with any staffing issues.

Again, it is a pleasure to work with each of you in the Regiment and I look forward to the future. While we are all aware of the challenges that operational medicine faces, we all need to continually remind ourselves that with these challenges come numerous opportunities to make a real difference in the lives of those who rely upon us. *De Oppresso Liber!*





Rhett Wallace MD FAAFP  
LTC MC SFS DMO  
Senior Medical Advisor  
NATO SOF Coordination Center



Bonjour from the Supreme Headquarters Allied Powers Europe (SHAPE), deep in the heart of Wallonia in Mons, Belgium. Since my arrival a year ago as the first North Atlantic Treaty Organization (NATO) SOF Senior Medical Advisor (MEDAD), the NATO Special Operations Coordination Center (NSCC) has moved from “concept,” through initially operational capable, to declaring full operational capability, with recent approval to progress toward becoming a NATO SOF Headquarters (NSHQ). Currently we stand as a fully-functioning and operationally relevant organization tasked with advising, coordinating, and influencing NATO operations, policies, and exercises.

Many readers are familiar with the challenges of establishing a new organization – wading through the process of identifying priorities, developing a network of key stakeholders, writing standard operating procedures, and moving forward with the work at hand. This year has included all of that and more. It is more than a job; it’s an adventure!

As all good SOF operations begin, so has this one, with gathering information, learning the language and culture of the locals, establishing relationships, and then through and with the indigenous population affecting our desired change (in this context, however, the indigenous population is made up of the Allies). My goal as the Senior Medical Advisor is to set the conditions and create the policy and doctrine for defining and understanding international SOF medical capabilities and requirements. This will enable NATO SOF to support operations with the right people (ca-

pability), in the right place, at the right time to keep our forces healthy, mitigate risk, and decrease morbidity and mortality.

Understanding NATO and operating within its combined, joint structure can at times be frustrating. Some of you have experienced this while operating within current or past NATO operations. NATO has its own culture, language, and politics all filtered through a collective consensus of political will.

NATO is currently an Alliance of 28 nations with Albania and Croatia added this year; and 26 of these possess their own Special Operations Forces. Each nation within the Alliance has as an equal voice, and remains sovereign as they contribute politically to exert their national wills, agendas, and goals within the Alliance. The North Atlantic Council (NAC) is NATO’s supreme political body and is located in Brussels, Belgium. The NAC’s guidance is delegated through the International Staff (IS) dealing with political issues, and through the Defense Planning Committee (DPC) and Military Committee (MC) dealing with military aspects of NATO. The Allied Command for Operations (ACO), under the Command of the Supreme Allied Commander Europe (SACEUR), is the military arm of this consensual political body. The ACO is located in Mons, Belgium at SHAPE. The ACO, through the direction of the NAC, the Defense Planning Counsel (DPC), the Military Committee (MC) and the International Staff (IS) is NATO’s military means by elective, collective contribution to effect change desired by NATO’s consensual political will.

Unlike the United States military decision-making processes, where operational control and chain-of-command are, hopefully, clear and established, NATO operations are oftentimes managed under administrative control, using a variety of potential lead-nations, with contributing nations retaining sovereignty to opt in or out of specified missions, based on their national-political motivations. These national caveats can be frustrating, but are essential to maintaining national sovereignty within the Alliance. The challenge then of understanding and effectively operating within NATO is to realize not only the capability of each contributed force, but also the political sensitivities and restrictions of each nation within a given operational environment. *Savey vous!?*

With that in mind, I continue to work to gain consensus to establish policies, directives, and SOF medical doctrine as a foundation for NATO SOF medical operations and planning. The key being establishing common ground and agreement and, through dialogue and debate, negotiating the finer nuances of what is salient.

Within the NSCC's educational activities, SOF Health Service Support Planning is currently included in our Combined Joint Staff Officer's and the International Security Assistance Forces (ISAF) Staff Officer's Courses. Within the newly published Special Operations Task Group (SOTG) and Combined Joint Forces Special Operations Component Command (CJFSOCC) Manuals chapters are dedicated to Medical Support Planning. These manuals are used as reference materials within NATO SOF courses, ISAF, and by nations contributing to NATO SOF operations.

Another item that needs to be highlighted and disseminated is the ISAF SOF HQ medical directive. This directive was developed by the NSCC, in coordination with ACO, Joint Forces Command (JFC) Brunsum, and ISAF MEDAD's. It provides SOF medical planners with a theater-level medical support planning tool, and promulgates understanding of regional nuance, national caveats, and capabilities that directly affect SOF operations. The intent of this document is to provide SOF elements at any level who contribute to ISAF operations, situational awareness and the tools to effectively conduct SOF operations either regionally or inter-theater. If your unit is currently contributing to ISAF, or is planned to do so, please contact me at the NSCC for access, exchange of information, and updates.

I would also like to request your participation in important upcoming events to keep NATO SOF medical support and capability visible at the Operational Command and International Medical Command level. The 2nd SOF Commanders Symposium to be held in Rome, Italy, this September will highlight to SOF Commanders the progress made thus far

within ISAF SOF Medical support. Our goal will also be to promote consensus on medical capability standards for adequate support across the operational continuum to SOF operations. The next opportunity then will be the 2nd NATO Medical Operations Conference to be held in Heidelberg, Germany, this October. The NSCC has coordinated a sub-conference, the first NATO SOF Medical Operations Conference. The intent of this conference is to bring Medical Command and SOF Medical Surgeons/Planners together to foster dialogue, develop consensus, and inculcate international advances and lessons learned into new NATO policy, doctrine and standards relating to medical capability and requirements.

Other opportunities for collaboration are the Special Operations Medical Association (SOMA) meeting in Tampa, Florida, and the Tactical Combat Casualty Care Symposium in Pfullendorf, Germany, held annually in December and June, respectively. At SOMA this December, I plan to provide an update on the decisions, advances or barriers to change thus far in publishing NATO SOF Medical policy and doctrine. The TCCC Symposium in Pfullendorf is the European version of SOMA hosted by Germany. It provides an excellent opportunity to establish contact with international SOF Surgeons, share ideas and concepts on equipment and technologies, and discuss lessons learned.

Lastly, with the help of a few friends and experts in their respective fields I have revised and re-written the job descriptions of the Medical Branch within the NSCC; I expect that the changes will be approved and implemented when the NSCC transitions to the NSHQ later this year. NATO will move away from Joint Staff designations to functional areas in April of 2010. The NSHQ Medical Branch will reflect the recommended changes having a Command Surgeon dual-hatted within the Command Group as special staff to the Commander, and Medical Branch Chief, within the Medical Branch, under the Deputy Chief of Staff for Support. This will maintain the command relationship and also the functional area of the Medical Branch. I am hoping to expand the Medical Branch from the current two positions to a more capable organization of five. This will require approval as a part of our transition to NSHQ, but more importantly actually providing people against these positions from bidding nations to become a reality.

Over this past year I have had significant input and support from multiple Special Operations Command surgeons. I want to express heart-felt thanks for your support. I look forward to expanding this collective group of friends and colleagues, and continuing to use your input and insights to developing the way ahead.



LTC Craig A. Myatt, Ph.D., HQ USSOCOM Psychologist



The Special Operations Forces (SOF) psychology community heralds the leadership and success of the outgoing USSOCOM Command Surgeon and welcomes the same measure of professionalism from his successor. The outgoing Command Surgeon's vision, to develop a behavioral health element in the Command Surgeon's Office, was timely and will ultimately enhance the effectiveness of SOF and strengthen the role that psychologists in the SOF community provide to commanders, first-line supervisors, team leaders, and Families.

The ongoing guidance provided to the Resilience Enterprise Working Group (REWG) from the USSOCOM Commander, combined with the immediate assistance rendered by the incoming Command Surgeon, give the REWG continued and uninterrupted leadership support to remain focused on an essential endstate goal: to sustain enduring operational readiness in SOF and for their Families.

While guidance, assistance, support, and commitment are essential for the development of a USSOCOM Resilience Enterprise Program, one of the more salient factors ensuring initial success for the program is good old-fashioned HARD WORK. REWG members saw the successful approval of the initial capabilities document (ICD) for the REWG in accordance with the group's charter. The March 13, 2009, REWG charter stipulated that an ICD must be generated within 75 working days. Several products from the April 9, 2009, REWG meeting met requirements for inclusion of the REWG as a specific capability in the Warrior Rehabilitation Performance Center Program ICD. As a part of the Human Capital Preservation program of record, the REWG obtained ICD approval from the USSOCOM

Deputy Commander on June 2, 2009, through approval of the WRPC Program ICD. Hard work from the REWG members made that happen.

The REWG held its first conference on 7 and 8 July and included the participation of both the outgoing and incoming USSOCOM Command Surgeons. The July conference marked another milestone in the development of the USSOCOM Resilience Enterprise Program. During the proceedings, REWG members defined resilience (for SOF-peculiar applications) as the ability to sustain, enhance, and quickly recover an optimal level of performance. The members also revised the REWG restated mission as the following: "To sustain combat power by increasing resilience in SOF and SOF Families to meet the challenges of a changing environment." Finally, as part of an extensive action plan, the REWG set the stage for the rapid development (within three weeks) of a draft DCR (Doctrine, Organization, Training, Materiel, Leadership and Education, and Facilities Change Recommendation) for circulation through the REWG in August. Hard work from the REWG members made that happen too.

Hard work by the REWG is recognized as a necessary response to the difficult challenges faced daily by SOF and SOF Families. Within the SOF psychology community there is a growing awareness that our forces do not have a significant problem with respect to behavioral health. On the other hand, there is a growing sense of the potential for "burnout" in both SOF and their Families. One of the REWG members recently discussed how SOF warriors and their Families face significant emotional and physical burnout because of the sustained and recurring nature of overseas contingency operations,



rigorous training, ongoing garrison functions, information overload, the inability to disengage from threats to self and Family, and the unpredictability of deployment cycles.

Burnout in that context is a measurable form of fatigue. Fatigue is both emotional and physical. It can be separate from, but related to, cognitive performance and manifests itself in several different ways. Fatigue (or burnout in the words of an REWG member) decreases the overall capacity of individuals, Families, and organizations to negotiate the challenges they face. He went on to state that burnout (or fatigue) “affects job performance, retention, Family dynamics (Family interactions), and behavioral health status.”

From that perspective, resilience is not a behavioral health issue by itself, but a subset of broader organizational characteristics that include leadership, education,

training, and culture. Some members of the REWG agree that “resilience generally emerges in people who have trained hard (proving themselves physically tough), have particular attitudes, cognitive and emotional skills, and a deep determination to overcome serious challenges (physical and intellectual).” Demonstrating exactly how resilience as a SOF-peculiar application for SOF personnel and their Families is an organizational and leadership issue, as well as an operational force-protection issue, is a daunting challenge. It will not be easy. However, continued hard work on the part of the REWG members will demonstrate precisely how resilience as a SOF peculiar application for SOF personnel and their Families is an organizational, leadership, cultural, and force-protection issue, combined, and how building resilience in SOF and SOF Families sustains combat power.





LTC Bill Bosworth, DVM, USSOCOM Veterinarian



COL Newton has brought up a great topic on the Force Health Protection measures we take to protect service members against rabies. I'm going to expand upon his article by outlining the procedures to submit a sample for rabies testing to the two DOD veterinary laboratories from theater. The contact information for both labs is listed at the end of this article.

The process for submitting samples from Afghanistan and Iraq is well established, and the theater Veterinary Treatment Facilities (VTFs) submit samples to the Veterinary Laboratory-Europe (VLE) on a weekly basis. It is best to let the Medical Detachments, Veterinary Services (MDVS) in those areas submit samples that you have, rather than try to submit them on your own. For contingency operations in areas that do not have a conventional veterinary unit presence, it is recommended that the unit conduct a "dry run" sample submission. This will identify any areas where the sample can be delayed, such as foreign customs offices. When submitting a dry run sample submission, notify the laboratory that you are sending it to, use the same shipping materials you would use in a real submission, and submit something the same approximate size and weight as an animal head, such as a five pound ham or turkey breast. The use of food will give the lab an idea if the sample can maintain the proper temperature during shipping. You can contact the closest theater VTF or either laboratory if you have any questions about how to submit a sample.



Here is the extract from the Laboratory Submission Guide to submit a brain for rabies testing at either of the two labs:

**7-3. Diagnostic Samples (Blood, serum and tissue samples)**

a. Rabies Diagnosis Sample - brain tissue

b. Submit all requests for rabies diagnosis testing on DD Form 2620, "Request for and Report of Laboratory Rabies Test" (electronic form available at <http://www.dtic.mil/whs/directives/in-fomgt/forms/eforms/dd2620.pdf>).

c. Wild animals, domesticated dogs and cats (whose owners cannot be readily identified) that have exposed a person should be euthanized immediately upon capture and submitted for testing.

d. Preparation of Specimen:

(1) Decapitate the animal and place the head in a plastic bag and seal. Place the sealed specimen in a second heavy plastic bag and seal the second bag. Send the entire carcass of small animals such as bats.

(2) Refrigerate immediately. Freezing animal specimens is not recommended unless a delay in shipment is expected.

e. Packing Shipping Containers:

(1) Add sufficient refrigerant to an insulated shipping container to maintain a temperature of 0 to 4°C during transit.

(2) Use drip-free gel packs as a refrigerant. Pack refrigerant in a separate bag than the sample. **Liquid must not leak from the shipping container during transit so DO NOT USE wet ice to ship!**

**(3) Labeling Shipping Containers and Shipping Documents**

(a) Animal specimens for rabies diagnosis are considered **DIAGNOSTIC** specimens. Special labeling is not required for shipment of diagnostic specimens. **DO NOT** label the exterior of the shipping container as a “rabies specimen.”

(b) Place the completed DD Form 2620 in a sealed plastic bag and place it on top, between the inner and outer containers. Affix a copy of the request form, in an envelope, to the top of the outer shipping container. Be sure to include a point of contact who can receive the laboratory report upon completion of testing. Phone numbers for that individual (day and night) must be listed.

(c) The phrase **“Diagnostic Specimen – Animal”** should be used on all transportation documents (GBL, Airbill, etc.) to describe the specimen shipped. **DO NOT** mention “rabies.”

c. Method of Shipment: Ship by the most expeditious means (overnight, next day delivery) available. If shipping on a Friday, the shipper must be specifically told that the item needs to be delivered (the following day) on a Saturday and the laboratory notified so that they can have an employee available to receive on a Saturday.

d. Notify the laboratory **by telephone** as soon as the specimen has been shipped and provide the following:

- (1) Type of animal.
- (2) Indicate whether or not human exposure was involved.
- (3) Specify the method of

shipment used and the sample’s estimated time of arrival to the lab.

**NOTE:** Notification is vitally important, especially when a rabies suspect sample is shipped for Saturday or holiday delivery. The laboratory is normally not staffed on weekends/holidays and special arrangements must be made to receive and process the specimen.

One of the capabilities that the MDVS now have in Iraq and Afghanistan is a rabies screening test that can be conducted at the VTF. The direct rapid immunohistochemistry test (DRIT) was developed at the Centers for Disease Control and Prevention (CDC) as an environmental surveillance, screening, and data gathering tool. Army veterinary pathologist LTC Greg Saturday from VLE was trained by the CDC to conduct the test, and he has traveled to Iraq and Afghanistan training the MDVS to run the DRIT test in their VTFs. The DRIT test is a ten-step process that can be completed in about an hour. Impression smears of the obex of the brain stem are made and fixed in formalin, and are then held until there are enough to batch test – usually ten samples plus a negative and positive control. At the end of the hour long process, the samples are viewed under a microscope to look for red inclusions in the sample. The presence of red inclusions indicates a rabies positive sample. Any DRIT positive sample tissue must be sent to VLE for a confirmatory direct fluorescent antibody (DFA) test. Studies have shown that the DRIT has specificity and sensitivity equivalent to the DFA.

**POINTS OF CONTACT**

**Worldwide:**

DOD Veterinary Food Analysis and Diagnostic Laboratory (FADL)

Attn: MCVS-Lab

2472 Schofield Rd Suite 2630

Fort Sam Houston, TX 78234-6232

**Capabilities:** Full chemical, microbiological and diagnostic

**Deputy Director:** MAJ Alisa Wilma, 210-295-4322, [Alisa.WilmaMAJAMEDDCS@amedd.army.mil](mailto:Alisa.WilmaMAJAMEDDCS@amedd.army.mil)

Rabies POCs: Edwin Cooper, 210-295-4920, [Edwin.cooper@amedd.army.mil](mailto:Edwin.cooper@amedd.army.mil); Michael Gray, 210-295-4736, [Micheal.gray@amedd.army.mil](mailto:Micheal.gray@amedd.army.mil)

DSN: 421-4604/4761

Comm: 210-295-4604/4761

Sample receiving area: 210-295-4210

FAX: 210-270-2559



## Europe, Mideast, Africa and SWA

U.S. Army Veterinary Laboratory-Europe (VLE)  
CMR 402  
APO AE 09180

**Capabilities:** Most chemical, microbiological, and limited diagnostic

**Chief of Diagnostics:** LTC Greg Saturday, DSN 314-486-8963, [greg.saturday@us.army.mil](mailto:greg.saturday@us.army.mil)

**Rabies POC:** Mrs. Leslie Fuhrmann,  
[leslie.fuhrmann@us.army.mil](mailto:leslie.fuhrmann@us.army.mil)  
DSN: 314-486-8300/7241  
Comm: 011-49-6371-86-8300/7241  
(Landstuhl, GE)  
DSN FAX: 314-486-7075  
Comm FAX: 011-49-6371-86-7075

## REFERENCES

*Sample Submission Guide, January 2009*; DOD Veterinary Food Analysis and Diagnostic Laboratory (FADL),  
<http://www.vetlab.army.mil/documents/LABguide2009.pdf>.

*Standard Operating Procedures for the Direct Rapid Immunohistochemistry Test (DRIT) for the detection of rabies virus antigen*; Centers for Disease Control and Prevention, Rabies Section.

Evaluation of a Direct, Rapid Immunohistochemical Test for Rabies Diagnosis, Lembo, et.al., *Emerging Infectious Diseases*, Vol. 12, No. 2, Feb 2006.

REQUEST FOR AND REPORT OF LABORATORY EXAMINATION FOR RABIES				
<b>PRIVACY ACT STATEMENT</b>				
AUTHORITY: Title 10, United States Code, Sections 3013, 5013, and 8013.				
PRINCIPAL PURPOSE(S): To provide for documentation of the results of laboratory examinations of a deceased animal for rabies.				
ROUTINE USE(S): The results of the examinations are used to determine the proper medical management of patients potentially exposed to rabies because of a bite/scratch inflicted by the animal described and belonging to the owner named. The information may also be used to: aid in preventive health and communicable disease control programs; report medical conditions required by law to Federal, state, and local agencies; compile statistical data; conduct research; teach; assist in law enforcement, to include investigations and litigation; and evaluate the care provided.				
DISCLOSURE: Voluntary; but if information is not provided, all pertinent and relevant information regarding the medical history of the animal cannot be evaluated. Comprehensive medical care to the individual potentially exposed to rabies may not be possible, but care will not be denied.				
1. TO		2. FROM		3. TELEPHONE NUMBERS (incl. Area Code)
				(1) DUTY (2) AFTER HOURS
				DSN DSN
				COMMERCIAL COMMERCIAL
<b>SECTION I - REQUEST FOR TEST</b>				
<b>PART A - IDENTIFICATION</b>				
3. OWNER OF ANIMAL (Last Name, First, Middle Initial)		4. ANIMAL		
		a. SPECIES	b. PET OR STRAY	c. AGE
<b>PART B - SYMPTOMATOLOGY (Past 3 to 5 days) (X all blocks that apply)</b>				
5. COULD ANIMAL CLOSE MOUTH?		6. SALIVATING?		7. ABLE TO DRINK WATER?
<input type="checkbox"/> UNKNOWN <input type="checkbox"/> NO <input type="checkbox"/> YES		<input type="checkbox"/> NO <input type="checkbox"/> YES		<input type="checkbox"/> UNKNOWN <input type="checkbox"/> NO <input type="checkbox"/> YES
8. LOSS OF APPETITE?		9. EATING UNUSUAL THINGS?		10. DIFFICULTY IN SWALLOWING?
<input type="checkbox"/> UNKNOWN <input type="checkbox"/> NO <input type="checkbox"/> YES		<input type="checkbox"/> UNKNOWN <input type="checkbox"/> NO <input type="checkbox"/> YES		<input type="checkbox"/> UNKNOWN <input type="checkbox"/> NO <input type="checkbox"/> YES
11. NERVOUS OR UNUSUAL BEHAVIOR?		12. PARALYSIS OF ANY KIND?		13. DATE FIRST NOTICED SICK
<input type="checkbox"/> UNKNOWN <input type="checkbox"/> NO <input type="checkbox"/> YES		<input type="checkbox"/> UNKNOWN <input type="checkbox"/> NO <input type="checkbox"/> YES		
14. DATE OF DEATH		15. MANNER OF DEATH		
		<input type="checkbox"/> DIED <input type="checkbox"/> EUTHANIZED		
<b>PART C - HISTORY</b>				
16. HAD ANIMAL BEEN VACCINATED AGAINST RABIES?		b. DATE		c. TYPE OF VACCINE
a. (X one) <input type="checkbox"/> NO <input type="checkbox"/> YES				
<b>PART D - HUMAN EXPOSURES</b>				
17. NAME (Last, First, Middle Initial)		ADDRESS (Street, City, State, Zip Code)		TELEPHONE NUMBER (Include Area Code)
a.		b.		c.
18. CLINICAL DIAGNOSIS, NECROPSY FINDINGS, AND REMARKS				
19. VETERINARIAN a. TYPED NAME (Last, First, Middle Initial) b. GRADE c. TITLE d. SIGNATURE e. DATE				
<b>SECTION II - LABORATORY REPORT OF RABIES EXAMINATION</b>				
20. DATE SPECIMEN RECEIVED		21. CONDITION		22. LAB ACCESSION NUMBER
23. FLUORESCENT ANTIBODY RESULTS		24. RESULTS TELEPHONED a. TO b. DATE c. HOUR d. BY		
25. CELL CULTURE RESULTS		26. FINAL LABORATORY DIAGNOSIS		
27. SUBMITTED BY a. TYPED NAME (Last, First, Middle Initial) b. GRADE c. TITLE d. SIGNATURE e. DATE				

DD Form 2620, JUN 92

(Addn Professional 5-0)



Blank DD Form 2620, Request for and Report of Laboratory Examination for Rabies

<http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd2620.pdf>

## *Need to Know*

### **Navy Safe Harbor Taking Care of Wounded, Ill, and Injured Sailors, Coast Guardsmen, and Their Families**

HM2 Debora Gatzke

Navy Safe Harbor provides Sailors, Coast Guardsmen, and their Families a beacon of hope through non-medical support following a serious illness or injury.

Navigating the waters of recovery following a serious illness or injury is often overwhelming and exhausting for a servicemember and his or her Family.

“Questions about pay and benefits, housing adaptation, and employability murky the waters of the recovery process,” said Commanding Officer of Navy Safe Harbor, CAPT Key Watkins. “While providing bedside care for their loved-ones, Families often don’t have the resources or time to manage these arising issues.”

Seventeen Safe Harbor non-medical care managers tailor support to each enrolled servicemember’s recovery and reintegration needs. Support includes pay and personnel issues, invitational travel orders, lodging and housing adaptation, child and youth care, respite care, recreation and leisure opportunities, transportation needs, legal and guardianship issues, education and training benefits, commissary and exchange access, traumatic brain injury/post-traumatic stress support services, and much more.

The non-medical care managers are located at seven major Navy treatment facilities throughout the United States, four VA polytrauma centers, Brooke Army Medical Center, and the USSOCOM Care Coalition. The non-medical care manager located at USSOCOM assists specifically with SOF issues.

This is a program that has been around for a while, but needs to be spread within the corpsman and medical community. We, as a whole, need to find ways

to spread this wonderful opportunity to our wounded Sailors and SOF Warriors.

A Navy Safe Harbor representative would be glad to visit and educate Navy medical personnel on the program and answer any questions pertaining to their patients’ care.

“Enrollment eligibility is not limited to combat-related wounds or injuries,” said Watkins. “Sailors injured during liberty or through shipboard accidents, as well as those that have incurred a serious illness, whether physical or psychological, are all welcomed into Navy Safe Harbor.”

Enrollment in Safe Harbor is voluntary. Sailors and Coast Guardsmen may be referred to Safe Harbor through a number of advocates, including the medical treatment facilities medical staff, the Wounded Warrior Resource Center, or their VA clinical case manager. Families and individuals may also self-enroll through Safe Harbor’s 24/7 toll-free care line, 877-746-8563; the Website, [www.safeharbor.navy.mil](http://www.safeharbor.navy.mil); or sending an inquiry to [safeharbor@navy.mil](mailto:safeharbor@navy.mil). USSOCOM Sailors and Families may contact HM2 Gatzke directly at 813-826-2601 or by email at [Debora.gatzke@socom.mil](mailto:Debora.gatzke@socom.mil).

Navy Safe Harbor’s goal is to return Sailors to duty and, when not possible, work collaboratively with federal agencies including the VA, Department of Labor, and state and local organizations to ensure successful reintegration of Sailors back into their communities.

“Navy Safe Harbor support does not end at the medical treatment facilities’ door,” said Watkins. “The key to Safe Harbor’s success is providing servicemembers with a lifetime of care and support.”

# SOF RELATED BOOK LIST

## SOF and SOF Medicine Book List

We haven't published the SOF reading list since the Summer 06 edition and recently received a request to republish it.

Those of you who know COL Farr's history of joining the Army at age 18 may realize that he has evidently conned the Army into sending him off for long term civilian schooling for his bachelor's degree, two master's degrees, and his doctor of medicine. Each time, he bought books. So below is his book list of military medical history and Special Operations Forces history books currently in his library. For a detailed list with the publishers and date of publication, please contact the JSOM at [JSOM@socom.mil](mailto:JSOM@socom.mil).

If anyone has other books they would like to add to the list, let us know. The intent is to present a concise list of the vast array of reading material available that pertains to the mission of Special Operations – both past and present.

We also strongly encourage readers to write a short review for the books they have read and/or have personal first hand knowledge concerning a specific selection. This will help maintain a high degree of content validity.

TITLE	AUTHOR	ISBN
15 Months In SOG: A Warrior's Tour	T.L. Nicholson, T.P. Nichols	0804118728
90 Minutes at Entebbe	W. Stevenson, U. Dan	0553104829
200 Years of Military Medicine	R.C. Engelman	
A Bugle Calls: The Story of the Witwatersr and Rifles	S. Monic	62013984
A Concise History of U.S. Army Special Operations Forces	G.T. Barker	0922004099
A Concise History of the U.S. Army Airborne Infantry	G.T. Barker	0922004021
A Concise History of U.S. Army Airborne Infantry	G.T. Barker	0922004013
A Concise History of U.S. Army Special Operations Forces	G.T. Barker	
A Confederate Nurse: The Diary of Ada W. Bacot	A.W. Bacot, J.V. Berlin	0872499707
A Confederate Surgeon's View of Ft. Donaldson...	J. Stanbery	
A Historical Perspective of SOF as Instruments of Strategy	G.D. Jones	CGSC 1991
A History of Medicine in South Carolina: 1825-1900	J.I. Waring, R.H. Shryock	SCMA
A History of Military Medicine	R.A. Gabriel, K.S. Metz	031327746X
A History of Special Forces in Somalia 1992-5	J.D. Celeski	
A Man Called Intrepid	W. Stevenson	0345310233
A Medical Tour Through the Whole Island of Great Britain	L. Appleby	05711739X
A Prototype of a Confederate Hospital Center...	P.W. Houck	B0006ELBY Y
A Saw, Pocket Instruments, and Two Ounces of Whiskey:		
Frontier Military Medicine in the Great Basin	A.P. Sohn	0870622722
A Soldier with the Arabs	J.B. Glubb	0006DI81O
A Soldier's Story: The Double Life of a Confederate Spy	D.L. Phillips	567994253
A Special Breed of Man	E. Edell	0934588082
A Surgeon's Civil War: The Letters of Daniel M. Holt	J.M. Greiner, et al.	0873384946
A Study of the Medical Support to the Union & Confederate		
Armies During the Battle of Chickamauga: Lessons &		
Implications for Today's U.S. Army Medical Department Leaders	D.A. Rubenstein	CGSC, 1990
A Swift, Elusive Sword: What if Sun Tzu and John Boyd Did		
a National Defense Review?	C.W. Richards	1932019014
A Systematic Review of "Commando" (Special) Operations		
1939-1980	E. Lutwak, et al.	
A Texas Surgeon in the C. S. A.	J.Q. Anderson	0007E4AEG
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The Country Team	R. Moore	B0006BOOEQ
The Dahlgren Affair: Terror and Conspiracy in the Civil War	D.P. Schultz	0393046621
The Devil's Brigade	R.H. Adleman, G.H. Walton	1591140048
The Eagle's Talons: The American Experience at War	D.M. Drew, D.M. Snow	1410200698
The Elite: The Story of the Rhodesian Special Air Service	B. Cole	0620074213
The Evolution of Preventive Medicine in the US Army	S. Bayne-Jones	1114667943
The Fall of Eben Emael	J. Mrazek	0891416641
The German Northern Theater of Operations, 1940-1945	E.F. Ziemke	B0007ETEOM
The Golden Jubilee of the Association of Military Surgeons of the United States, a History of its First Half-Century -1891-1941	E.E. Hume	B0007EZYV4
The Great Raid on Cabanatuan	W.B. Breuer	0471037427
The Green Berets	R. Moore	0312984928
The Healers: A History of American Medicine	J. Duffy	0252007433

TITLE	AUTHOR	ISBN
The Healer's Road	J.L. Reasoner	0515117625
The Hunt for Bin Laden	R. Moore	0375508619
The Illustrated Art of War	Sun Tzu, T. Cleary	1570624224
The Imperial War Museum Book of War Behind Enemy Lines	J.F. Thompson	157488381X
The Intrepid Guerrillas of North Luzon	B. Norling	0813121183
The Jungle is Neutral	F. Spencer-Chapman	0583128165
The Killing of Reinhard Heydrich: The SS Butcher of Prague	C.A. MacDonald	0306808609
The Kinder, Gentler Military	S. Gutmann	0684852918
The Lincoln Conspiracy	D.W. Balsiger, C.E. Sellier	091721403X
The Man Who Tried to Burn New York,	N.H. Brandt	0425119181
The Medical Support System for the Confederate Army of Tennessee During the Georgia Campaign, May-Sept. 1864	F.R. Freemon	TN Hist. Q., 1993
The Medics' War. United States Army in the Korean War	A.E. Cowdrey	B0006ELAA4
The One That Got Away	C. Ryan	1574881566
The Parachute Ward: A Canadian Surgeon's Wartime Adventures in Yugoslavia	B.J. Street	0886191033
The Partisans, United States Holocaust Memorial Museum	Y. Arad	0896040100
The Protected Will Never Know	L. Wade	0804117136
The Roots of Counter-Insurgency: Armies and Guerrilla Warfare	I.R. Beckett	0713719222
The Secret War Against Hanoi: Kennedy and Johnson's Use of Spies, Saboteurs, and Covert Warriors in North Vietnam	R.H. Shultz	0060194545
The Secret War for the Union: The Untold Story of Military Intelligence in the Civil War	E.C. Fishel	0395742811
The Secret War Report of the OSS	A.C. Brown	0425032531
The Seven Military Classics of Ancient China	R.D. Sawyer	0813312280
The Silent War: South African Recce Operations 1969 to 1994	P. Stiff	1919854045
The Six Secret Teachings on the Way of Strategy	R.D. Sawyer, et al.	1570622477
The Social Transformation of American Medicine	P. Starr	0465079342
The Southern Soldier's Health Guide	J.S. Wilson	1877791075
The Soviet Partisan Movement, 1941-1944: A Critical Historiographical Analysis	L.D. Grenkevich, D.M. Glantz	0714644285
The Story the Soldiers Wouldn't Tell: Sex in the Civil War	T.P. Lowry	0811715159
The Story of the Arab Legion	J.B. Glubb	B0007J7994
The Sword and the Olive: A Critical History of the Israeli Defense Force	M.L. Van Creveld	1891620053
The Tao of War	Wang Chen, R.D. Sawyer	0813340810
The Tao of Peace	Wang Chen, R.D. Sawyer	1570625115
The Tao of Spycraft: Intelligence Theory and Practice in Traditional China	R.D. Sawyer	0813333032
The Uncivil War: Irregular Warfare in the Upper South, 1861-1865	R.R. Mackey	0806136243
The Vietnams of the Green Berets	G.M. Patric	B0006EKUAA
The War Between the Spies: A History of Espionage During the American Civil War	A. Axelrod	0871134829
The War for the Cities	R. Moss	0698104498
The Witch Doctor	M. Temchin	0896040453
The Wounded River: The Civil War Letters of John Vance Lauderdale, M.D.	J.V. Lauderdale, P. Josyph	0870133284
The Wrong War: Why We Lost in Vietnam	J. Record	155750699X
Theory and Practice in American Medicine	G.H. Brieger	0882021583
This Awful Drama: General Edwin Gray Lee, C.S.A. and His Family	A.L. Levin	0533072425
Trends in Outside Support for Insurgent Movements	D.L. Byman, et al.	0833030523
True Americanism: Green Berets and War Resisters	D.M. Mantell	0807724297
Twilight Warriors: Inside the World's Special Forces	M.C. Arostegui	0312152345
Ukrainian Resistance Movement-Medical Services	M. Ripeckyi	0920092306

TITLE	AUTHOR	ISBN
Unconventional Warfare: Rebuilding U.S. Special Operations Forces	S.L. Marquis	0815754752
Uneasy Warriors: Coming Back Home	V. Coppola	1563521970
United States Army in World War II: Special Studies Military Relations Between the United States and Canada 1939-1945	S.W. Dziuban	0160018714
United States Army Logistics, 1775-1992: An Anthology	C.R. Shrader, J.W. Mountcastle	0898755301
U.S. Army Special Forces, 1961-1971	F.J. Kelly	B0006C7SMK
U.S. Army Counterinsurgency and Contingency Operations Doctrine, 1860-1941	A.J. Birtle	0788173278
U.S. Army Heraldic Crests: A Complete Illustrated History of Authorized Distinctive Unit Insignia	B.J. Stein, P.J. Capelotti	0872499634
U.S. Army Special Operations In World War II	D.W. Hogan	141021690X
U.S. Army Special Warfare: Its Origins	A.H. Paddock	0700611770
U.S. Special Operations Forces in Action: The Challenge of Unconventional Warfare	T.K. Adams	0714643505
USA Airborne 50th Anniversary Commemorative Edition	B. Hagerman	0938021907
War in Cambodia 1970-75	K. Conboy, K.R. Bowra	85045851X
War in the Shadows, Volumes 1 & 2	R.B. Asprey	0385034709
Warrior Politics: Why Leadership Demands a Pagan Ethos	Robert D. Kaplan	0375505636
Weapon of Choice	C.H. Briscoe, et al.	ACGSC 2003
When Sherman Marched North from the Sea: Resistance on the Confederate Home Front	J. Glass-Campbell	0807828092
White Dragon Two	K. Sibounheuang	1885354142
White Roses: Women Nurses in the Civil War	R.D. Larson	1577470117
White Tigers: My Secret War in North Korea	B.S. Malcom, R. Martz	1574881981
Who's Who from MACV-SOG	S. Sherman	1996
With Courage and Delicacy: Civil War on the Peninsula: Women and the U.S. Sanitary Commission	N. Scripture-Garrison	1882810392
Women at the Front: Hospital Workers in Civil War America	J.E. Schultz	080782867X
Yellow Fever and the South	M. Humphreys	0813518202
Yoni Netanyahu: Commando at Entebbe	D. Newberger-Speregen	0827606427
You're No Good to Me Dead: Behind Japanese Lines in the Philippines	R. Stahl	1557507937

### New Additions since first list:<sup>1</sup>

A Hundred Osamas: Islamist Threats & the Future of Counterinsurgency	S. Zuhur	SSI 2005
A Murder in Wartime: The Untold Spy Story That Changed the Course of the Vietnam War	J. Stein	0312070373
Age of the Guerrilla	F. Sully	0380023318
American Soldier	T. Franks	0060731583
Auguste Blanqui and the Art of Insurrection	S. Bernstein	0853152438
Chariots of the Damned: Helicopter Special Operations from Vietnam to Kosovo	M. McKinney, M. Ryan	0312291183
Charlie Wilson's War	G. Crile	0802141242
Combat in Russian Forests and Swamps		0160019451
Counterinsurgency Warfare	D. Galula	0275989410
Crisis Fleeting - Original Reports on Military Medicine in India and Burma in the Second World War	J.H. Stone	B000BKRZL6
Daring to Win: Special Forces at War	D. Eshel	1854091557
Duel for Kilimanjaro: An Account of the East African Campaign, 1914-1918	L.O. Mosley	B0007EE85C
Effects of Climate on Combat in European Russia		9997584538
Fatal Glory: Narciso Lopez and the First Clandestine U.S. War Against Cuba	T. Chaffin	0813916739
Five Years to Freedom	J.N. Rowe	0345314603
German Defense Tactics Against Russian Breakthroughs		9990202907



TITLE	AUTHOR	ISBN
Guerilla warfare	N.M. Blair	B0007JTGE0
Guerrilla	D. Rooney	1857533526
Guerrilla and Terrorist Organizations: World Directory and Bibliography	P. Janke	0029161509
Guerrilla Strategies: An Historical Anthology from the Long March to Afghanistan	G. Chaliand	0520044444
Guerrilla Warfare: Che Guevara	E.C. Guevara	0803270755
Guerrillas	J.L. Anderson	0142004979
Honduras To Haiti: Five Years In The Life Of A Special Forces Sergeant	R.W. Johnson	1410792781
Imperial Grunts	R.D. Kaplan	1400061326
Insurgency & Terrorism: Inside Modern Revolutionary Warfare	B.E. O'Neill, E.C. Meyer	1574883356
Insurgency and Counterinsurgency in the 21st Century	S. Metz	1584871792
<b>JSOU/NDIA Essays 2004-5</b>		
Kitchener: Architect of Victory, Artisan of Peace	J. Pollock	0786708298
Lapham's Raiders: Guerrillas in the Philippines, 1942-1945	R. Lapham, B. Norling	0813119499
Lettow-Vorbeck's Soldiers	W. Dobbertin	089839340X
Macarthur's Undercover War: Spies, Saboteurs, Guerrillas, and Secret Missions	W.B. Breuer	0785820485
Medical Support of the Army Air Forces in World War II	M.M. Link	0912799692
Medicine: For Mountaineering & Other Wilderness Activities 5th Edition,	J.A. Wilkerson, (Editor)	0898867991
Military Improvisations During the Russian Campaign		0160019443
Military Improvisations During the Russian Campaign		1410220842
Modern Insurgencies and Counter-Insurgencies; Guerrillas and Their Opponents Since 1750	I.F.W. Beckett	0415239346
Modern Irregular Warfare: In Defense Policy and as a Military Phenomenon	F.A. Heydte	0933488491
Mogadishu!	K. DeLong, S. Tuckey	0275949257
My Reminiscences of East Africa	P. Lettow-Vorbeck	0898391547
Night Combat	A. Toppe	0788170805
Night Stalkers: 160th Special Operations Aviation Regiment (Airborne)	F. Pushies	0760321418
Non-state Threats and Future Wars	R. Bunker	0714683086
Operationalizing COIN	J. Celeski	
Operations of Encircled Forces - German Experiences in WWII		B000AW7DIA
OSS	R.H. Smith	1592287298
Oxford Handbook of Tropical Medicine	M. Eddleston, S. Pierini, R. Wilkinson, R. Davidson	0198525095
Red Acropolis, Black Terror: The Greek Civil War and the Origins of Soviet-American Rivalry, 1943-1949	A. Gerolymatos	0465027431
Resisting Rebellion: The History and Politics of Counter-insurgency	A.J. Joes	0813123399
Revolutionary War in World Strategy, 1945-1969	R.G. Thompson,	0800867858
Rumsfeld's War: The Untold Story of America's Anti-Terrorist Commander	R. Scarborough	0895260697
Russian-Soviet Unconventional Wars in the Caucasus, Central Asia, and Afghanistan	R. Baumann	0160419530
SAS: With the Maquis	I. Wellsted	85367186X
Sharp Corners: Urban Operations at Century's End	R.J. Spiller	B0006RP25U
Small Unit Actions During the German Campaign in Russia		B000AMB17Y
Soldiers to the Rescue. The Medical; Responce to the Pentagon Attack.	S. Marble, E. Milhider	
Special Men and Special Missions: Inside American Special Operations Forces, 1945 to the Present	J. Nadel, J.R. Wright	1853671592
Stoic Warriors	N. Sherman	0195152166

<b>TITLE</b>	<b>AUTHOR</b>	<b>ISBN</b>
Sub Rosa	S. Alsop	0156863006
Tanganyikan Guerrilla	J.R. Sibley	
Terrain Factors in the Russian Campaign		016001946X
The Art of War Plus The Ancient Chinese Revealed Sun Tzu		1929194196
The Dressing Station: A Surgeon's Chronicle of War and Medicine	J. Kaplan	0802117074
The First Professional Revolutionist	E.L. Eisenstein	0674304004
The Medical Department: Medical Service in the War Against Japan	M. Condon-Rall, A. Cowdrey	0160492653
The Philippine War, 1899-1902	B.A. Linn	0700612254
The Politics of Resistance in France, 1940-1944: A History of the Mouvements unis de la Résistance	J. Sweets	0875800610
The Propensity of Things: Toward a History of Efficacy in China	F. Jullien, J. Lloyd	0942299949
The Shadow Warriors: O.S.S. and the Origins of the C.I.A.	B.F. Smith	0233975772
The Shining Path: A History of the Millenarian War in Peru	G.G. Ellenbogen, G. Gorriti	0807846767
The Withered Vine	C.R. Shrader	0275965449
The Women Who Lived for Danger	M. Binney	0060540877
The Zapatista Social Netwar in Mexico	D. Ronfeldt, et al.	0833026569
Theoretical Perspectives of Terrorist Enemies as Networks	R.G. Spulak	
They fought alone	J. Keats	B0006AYKWI
Tito's Partisans 1941-45	V. Vuksic	1841766755
U.S. Special Operations Forces in the Cold War	L. Thompson	1853675067
United States Army and World War 2: Selected Papers From the Army's Commemorative Conferences	J.L. Bellafaire	016049589X
War of the Flea: Classic Study of Guerrilla Warfare	R. Taber, B.E. O'Neill	1574885553
War Stories of the Green Berets	H. Halberstadt	076031974X
Warfare in the Far North	W. Erfurth	00075X6
Wilderness Medicine: Management of Wilderness and Environmental Emergencies.	P. Auerbach, MD	0323032281
Witness to War: An American Doctor in El Salvador	C. Clements	0553050648

The following is a compiled list of SOF related books recommended for your reading by those who were there. This list is complements of Len Blessing. Every attempt is made to maintain the list's integrity with respected and legitimate works. I have removed the books that duplicated COL Farr's list. Readers who feel a selection does not merit inclusion are encouraged to contact us with disputes.

<b>TITLE</b>	<b>AUTHOR</b>
00:19:57	Dave F. Stafford
A Tear For Somalia	Douglas T. Collins
(Written by a Brit who married a Somali woman while serving as a member of the British Camel Corps after the end of WWII. Not a history, but it does give insight into Somali society.)	
A Very Short War	John F. Guilmartin Jr
(About the last gunfight and the last sacrifices of the Vietnam-era war in the recovery of the crew and ship SS Mayaguez in 1975.)	
Advice and Support: The Early Years	Ronald H. Spector
Airborne and "Special Forces"	Hans Halberstadt
(non-fiction, good quick references, especially for family or civilians)	
American Guerrilla	Unknown
(WW II U.S. led guerrillas in Phillipines)	
Band of Brothers	Stephen Ambrose
(A great story about "E" Company, 506th PIR, 101st ABN Division in WWII.)	
Battle for the Central Highlands: A Special Forces Story	George E. Dooley
Beyond Nam Dong	Roger Donlon

TITLE	AUTHOR
Black Eagles (Fiction)	Larry Collins
Blackburns Headhunters (Part of a series of books on the area from Turkey to Tibet. Well researched and an excellent view of the region, its history, and various societies that live within the region.)	COL Donald Blackburn
Blackjack -33: With Special Forces in the Viet Cong Forbidden Zone	James C. Donahue
Blackjack -34 (Previously titled "No Greater Love")	James C. Donahue
Break Contact Continue Mission (Fiction)	Raymond D. Harris
Bunard: Diary of a Green Beret	Larry Crile
Che Guevarra on Guerrilla Warfare	Ernesto Gueverra
Covert Warrior	Warner Smith
Danger Close (Non-fiction. SF member charged with murder in a bar fight within 3 days of graduation from the Q Course.)	Mike Yon
Fighting Men: Stories of Soldiering	Jim Morris
Fire Your FPL's	Mike Di Rocco
Five Fingers	Gayle Rivers
Five Years To Freedom	James N. Rowe
Flags of our Fathers	James Bradley; Ron Powers
Foreign Devils on the Silk Road (Part of a series of books on the area from Turkey to Tibet. Well researched and an excellent view of the region, its history, and various societies that live within the region.)	Peter Hopkirk
Greatest Rescue Mission (Ranger operation to free POWs in the Philippines)	Shelby L. Stanton
Green Berets at War: U.S. Army Special Forces in Asia 1956-1975	Chalmers Archer Jr.
Green Berets in the Vanguard: Inside Special Forces 1953-1963	Mao Tse tung
Guerrilla Warfare: On Guerrilla Warfare	David H. Hackworth (COL); Tom Mathews
Hazardous Duty	Bernard Fall
Hell In A Very Small Place (Siege of Dien Bien Phu)	William J. Durker
Ho Chi Minh: A Life	Loyd Little
In The Village of the Man	Rohan Gunaratna
Inside Al Qaeda, Global Network of Terror	Eric L. Haney
Inside Delta Force: The story of America's elite counterterrorist unit	Charles M. Simpson III
Inside the Green Berets: The First Thirty Years	Norman H. Schwarzkopf (GEN Ret); Peter Petre
It Doesn't Take A Hero	Nina S. Adams (Ed)
Laos: War and Revolution	Peter Hopkirk
Like Hidden Fire (Part of a series of books on the area from Turkey to Tibet. Well researched and an excellent view of the region, its history, and various societies that live within the region.)	Donald W. Betts
Logistical Support of Special Operations Forces During Operations Desert Shield and Desert Storm	Kent White
Long Shadows (Fiction)	John Prados
Lost Crusader: The Secret Wars of CIA Director William Colby	Ben and Anne Purcell
Love and Duty	Roy P. Benavidez
Medal Of Honor	Noonie Fortin
Memories Of Maggie: Martha Raye: A Legend Spanning Three Wars	Colin Powell (GEN Ret); Joseph E. Persico
My American Journey	Richard S. Drury
My Secret War	Thomas B. Bennett
Night Jungle Operations	William R. Phillips
Night of the Silver Stars: The Battle of Lang Vei	



TITLE	AUTHOR
No Surrender (Japanese soldier who evaded capture and survived 30 years in the Philippines; it's a great book about perseverance and commitment to warrior ideals.)	Hiroo Onoda
Once A Warrior King: Memories of an Officer in Vietnam	David Donovan
O O T W Target Cuba	Robin Moore; J.C. Lamb
Operation Vulture	John Prados
OSS to Green Berets	Aaron Bank (COL Ret)
Parthian Shot	Loyd Little
Pathfinder: First In, Last Out (A very well written account of Richie Burns' first tour in RVN, during which he provided support to a Mike Force mission, and which describes other activities very similar to SF missions during the war.)	Richard C. Burns
Peoples' War, Peoples' Army	Vo Nguyen Giap
Perilous Options: Special Operations as an Instrument of U.S. Foreign Policy	Lucien S. Vandenbroucke
Phantom Warriors, Book II	Gary A. Linderer
Phantom Warriors: LRRPs, LRP's, and Rangers in Vietnam, Book I	Gary A. Linderer
Presidents' Secret Wars: CIA and Pentagon Covert Operations from World War II Through the Persian Gulf	John Prados
Rangers at War: Combat Recon in Vietnam	Shelby L. Stanton
Rescue Of River City	Drew Dix
Return of The Enola Gay	Paul W Tibbets
Return With Honor	Scott O'Grady (Capt); Jeff Coplon
Setting the East Ablaze (Part of a series of books on the area from Turkey to Tibet. Well researched and an excellent view of the region, its history, and various societies that live within the region.)	Peter Hopkirk
Seven Pillars of Wisdom (Middle East insight)	T.E. Lawrence
SF Bibliography: Collection of articles and other readings with Special Forces topics	Radix Press/Dan Godbee
Shadow War: Special Operations and Low Intensity Conflict	H.T. Hayden
Silent Birdmen (281st AHC pilot account; Project Delta Ops in Ashau Valley.)	A.L. Rampone
Slow Walk In A Sad Rain	John P. McAfee
SOG and SOG Photo Book	John Plaster
SOG: Volume I, II, III and IV	Harve Saal
SPEC OPS: Case Studies in Special Operations Warfare: Theory and Practice	William H. McRaven
Special Forces 1941-1987	LeRoy Thompson
Special Forces, the U.S. Army's experts in Unconventional Warfare	Caroll B. Colby
Special Men and Special Missions: Inside American Special Operations Forces, 1945 to the Present	Joel Nadel; J.R. Wright
Spies And Commandos	Kenneth Conboy
Stolen Valor	B.G. Burkett; Glenna Whitley
Strategy and Policy Background Umbrella Concept for Low Intensity Conflict	Alex and Hamilton Booz
Street Without Joy (French in Indochina; Good groundwork for SF in Vietnam)	Bernard B. Fall
Taking The High Ground: Military Moments With GOD	Jeff O'Leary (Col)
Talking with Victor Charlie: An Interrogator's Story	Sedgwick D. Tourison Jr
Tam Phu	Leigh Wade
The Barking Deer (Fiction)	Jonathan Rubin
The Blood Road: The Ho Chi Minh Trail and the Vietnam War	John Prados
The Chindit War	Shelford Bidwell

TITLE	AUTHOR
(Good section on Merrill's Marauders) The Devil's Guard	George R. Elford
(A non-SF book; a good read and supposedly historically accurate. Covers the war from the viewpoint of the ex-Nazi's who were in the French Foreign Legion fighting the Viet Minh.) The Dying Place	David A. Maurer
(Fiction) The Great Game	Peter Hopkirk
(Part of a series of books on the area from Turkey to Tibet. Well researched and an excellent view of the region, its history, and various societies that live within the region.) The Green Berets in Vietnam, 1961-71 The Hidden History of the Vietnam War The Last Confucian The Making of a Quagmire The Montagnards of South Vietnam The New Legions The Politics of Heroin in SE Asia (Essential reference for understanding the Golden Triangle.) The Price of Exit (Helicopter pilot, Lam Son 719 and CCN) The Raid The Ravens (The classic about our Bird Dog brothers) The Rescue of Bat-21 The Road to Arnhem: A Screaming Eagle in Holland The Secret Wars: A Guide to Sources in English, Volume II, Intelligence, Propaganda and Psychological Warfare, Covert Operations, 1945-1980 The Sorrow of War: A Novel of North Vietnam (This is a work of fiction with many facts written by a NVA Officer.) Tiger the Lurp Dog (Fiction) Tragedy in Paradise: A Country Doctor at War in Laos Trespassers on the Roof of the World (Part of a series of books on the area from Turkey to Tibet. Well researched and an excellent view of the region, its history, and various societies that live within the region.) Umbrella Concept for Low Intensity Conflict Unconventional Operations Forces of Special Operations Uneasy Warrior U.S. Army Special Forces 1952-84 U.S. Army Handbook for North Vietnam Dept. of Army: 550-57 U.S. Army Handbook for Cambodia Dept. of Army: DA Pam: 550-50 U.S. Army Handbook for Laos Dept. of Army: DA Pam: 550-58 U.S. Army Handbook for South Vietnam Dept. of Army: DA Pam: 550-55 U.S. Army Handbook: Minority Groups in the Republic of Vietnam: Ethnographic Series Dept. of Army: DA Pam: 550-105 U.S. Army Special Operations in World War II U.S. Special Forces Urgent Fury: The Battle for Grenada Valley of Decision: The Siege of Khe Sanh Vietnam Above The Tree Tops: A Forward Air Controller Reports Vietnam in American Literature Vietnam Military Lore: Legends, Shadow and Heroes Vietnam Order of Battle: A Complete, Illustrated Reference to the U.S. Army and Allied Ground Forces in Vietnam, 1961 - 1973 Vietnam Studies: Command and Control 1950-1969 Vietnam: A History	Francis J. Kelly John Prados Denis Warner David Halberstam Robert L. Mole Donald Duncan Alfred McCoy  Tom Marshall  Benjamin F. Schemmer Christopher Robbins  Darrel D. Whitcomb Donald R. Burgett Myron J. Smith  Bao Ninh  Kenneth Miller  Charles Weldon, MD Peter Hopkirk   Alex and Hamilton Booz Mark D. Boyatt Vincent Coppola Gordon L. Rottman   David W. Hogan Jr. Peter McDonald Mark Adkin John Prados John F. Flanagan Philip H. Melling Ray E. Bows (MSG Ret) Shelby Stanton  Maj Gen George Eckhardt Stanley Karnow

**TITLE****AUTHOR**

Vietnam: The Origins of Revolution  
Vietnam: The Secret War  
War Stories of the Green Berets: The Vietnam Experience  
War Story  
Warrior Healers  
We Were Soldiers Once and Young

John T. McAlister Jr  
Kevin M. Generous  
Hans Halberstadt  
Jim Morris  
Leonard D. Blessing Jr.  
Harold G. Moore (LTG); Joseph L. Galloway







## GENERAL REFERENCES

### ALERTS & THREATS

Bio-security Center: <http://www.upmc-biosecurity.org/>  
Epidemic and Pandemic Alert: <http://www.who.int/csr/en/>  
Global Disease Alert Map: <http://healthmap.org/en>  
Medical Threats Briefings (by Topic): <http://usachppm.apgea.army.mil/hiomtb/>  
Relief Web: <http://www.reliefweb.int/rw/dbc.nsf/doc100?OpenForm>  
Security News: <http://www.planetdata.net/> and <http://www.globalsecurity.org>

### BASIC REFERENCE:

Anatomy Atlases Online: <http://www.anatomyatlases.org/>  
Health and Medical Sites: <http://www.lib.uiowa.edu/hardin/md/idx.html>  
Health Sciences Libraries Online: <http://www.lib.uiowa.edu/hardin/hslibs.html>  
Martindale's Medical References: <http://www.martindalecenter.com/Medical.html>  
Medical Algorithms, Assessments, Scales, Scoring Systems & Tools: <http://www.medal.org/visitor/login.aspx>  
Medical Dictionary Online: <http://cancerweb.ncl.ac.uk/omd/>  
Merck Health Guides Online: <http://www.mercksource.com/>  
Military Medical Resources: <http://www.medtrng.com/medicaloperations.htm>  
National Library of Medicine Gateway: <http://gateway.nlm.nih.gov/gw/Command>  
Practice Guides: <http://www.fpnotebook.com/> ; <http://www.emedicine.com/> ; <http://www.lib.uiowa.edu/hardin/md/> and <http://www.acep.org/practres.aspx?id=30232>  
USUHS Learning Resource Center: <http://www.lrc.usuhs.mil/>

### BOOKS (ONLINE)

Books for Doctors: <http://www.freebooks4doctors.com/fb/special.htm>  
e-Learning Toolkit for Essential Surgical Care: <http://www.steinergraphics.com/surgical/index.html>  
Environmental Medicine Text: <http://www.envimed.com/emb.shtml>  
Dermatology: <http://telemedicine.org/stamford.htm>  
DSM-IV (Revised): <http://psych.org/MainMenu/Research/DSMIV.aspx>  
First Aid in Armed Conflicts: <http://www.icrc.org/web/eng/siteeng0.nsf/html/p0870>  
Global Health Council Publications: <http://www.globalhealth.org/publications>  
Medical Bookshelf: <http://www.ncbi.nlm.nih.gov/sites/entrez?db=books>  
Medical Books Online: <http://www.flyingpublisher.com>  
Military Medicine: <http://www.bordeninstitute.army.mil/published.html>  
Military Bio-defense Manuals: <http://usamriid.detrack.army.mil/education/instruct.htm>  
Merck Manuals Online: <http://www.merck.com>  
Merck - Medicus Portal: [http://www.merckmedicus.com/pp/us/hcp/hcp\\_home.jsp](http://www.merckmedicus.com/pp/us/hcp/hcp_home.jsp)  
Navy Diving Manual: <http://www.supsalv.org/manuals/diveman5/divManual5.htm>  
Operational Medicine: <http://www.operationalmedicine.org/>  
Primary Trauma Care Manual: <http://www.steinergraphics.com/surgical/manual.html>

### COURSES (ONLINE)

Medical Super Courses: <http://iier.isciii.es/supercourse/assist/topicsearch.htm>  
Virology Course: <http://web.uct.ac.za/depts/mmi/jmoodie/welcome1.html>

### JOURNALS (ONLINE)

Federal Medicine: <http://www.usmedicine.com/index.cfm>  
Medical Journals: <http://www.biomedcentral.com/> ; and <http://www.plos.org/>

Medical and Science Journals: <http://www.ispub.com/ostia/index.php?xmlFilePath=journals.xml>  
Medical and Science Journals for the Developing World: <http://www.biomedcentral.com/developingcountries>

## **TRAINING**

Advanced Burn Life Support: <http://www.ameriburn.org/ablscoursedescriptions.php>  
Advanced Disaster Life Support: <http://www.bdls.com/>  
Advanced Hazmat Life Support: [http://www.ahls.org/ahls/ecs/main/ahls\\_home.html](http://www.ahls.org/ahls/ecs/main/ahls_home.html)  
Advanced Medical Life Support: <http://www.naemt.org/AMLS/default.htm>  
Advanced Wilderness Life Support: <http://awls.org/index.htm>  
Aviation Medicine School: <http://usasam.amedd.army.mil/>  
Airway Management: <http://www.theairwaysite.com/>  
Bio-defense Education: <http://www.biodefenseeducation.org/>  
Biochemical Organic Radiological Disaster Educational Response System: <http://www.bordersalertandready.com/>  
Blast Injury Training: <http://www.bt.cdc.gov/masscasualties/tiidefacts.asp>  
Center for Domestic Preparedness: <http://cdp.dhs.gov/index.html>  
Combat Lifesaver: <http://www.combatreform.com/combatlifesaver.htm>  
Diploma in Remote and Offshore Medicine: <http://www.diprom.rcsed.ac.uk/>  
Disaster Education Extension Network: <http://eden.lsu.edu>  
Disaster Mental Health Institute: <http://www.usd.edu/dmhi/>  
Diver Medical Technician Training: <http://www.nbdhmt.com/dmt.html>  
Family and Primary Care Medicine Studies: <http://www.graham-center.org>  
Flight Medic Course: [http://usasam.amedd.army.mil/fm\\_course/index.htm](http://usasam.amedd.army.mil/fm_course/index.htm)  
Emergency Management Institute: <http://www.training.fema.gov/EMIWEB/>  
Health Care: <http://www.medweb.emory.edu/MedWeb/SPT—Home.php>  
Humanitarian Resource Institute: <http://www.humanitarian.net/>  
International Trauma Life Support Course: <http://www.itrauma.org/>  
JEMS Training Links: [http://www.jems.com/education\\_and\\_training/index.html](http://www.jems.com/education_and_training/index.html)  
NAEMT Training: <http://www.naemt.org/educationalPrograms/>  
Medicine for Mariners: <http://www.medicineformariners.com/>  
Medicine in Challenging Environments: <http://www.trueresearch.org/mice2006/>  
Pathology Training: <http://library.med.utah.edu/WebPath/webpath.html>  
Pre Hospital Trauma Life Support: <http://www.naemt.org/PHTLS/>  
Remote Area EMS: <http://www.raems.com/index.html>  
Remote Medicine Guides: <http://www.remotemedicine.org/Guides.htm>  
Surgical Education Online: <http://www.vesalius.com/cfoli.asp>  
TCCC Guidelines and References: <http://www.usaisr.amedd.army.mil/tccc.html>  
Terror Medicine: <http://www.terrormedicine.org/>  
Training in Tropical Diseases: <http://www.who.int/tdr/index.html>  
USMA Terrorism and Counter terrorism Training: <http://www.teachingterror.com/>

## **MEDICAL REFERENCES**

### **ADMINISTRATION AND CONTINGENCY PLANNING**

Disrupted Health Services: [http://www.who.int/hac/techguidance/tools/disrupted\\_sectors/en/index.html](http://www.who.int/hac/techguidance/tools/disrupted_sectors/en/index.html)  
Health and Disaster Preparedness Tools (USH&HS): <http://www.ahrq.gov/prep/>  
Hospitals for War Wounded - A Guide for Set Up: <http://www.icrc.org/web/eng/siteeng0.nsf/html/p0714>  
Emergency Preparedness Planning (CDC): <http://www.bt.cdc.gov/planning/>  
Public Health Emergency Countermeasures: <http://www.hhs.gov/aspr/ophemc/index.html>  
Public Health Emergency Countermeasures: <http://www.hhs.gov/aspr/ophemc/index.html>  
Public Health Preparedness Tools: <http://www.phppreparedness.info/tools.php>  
Surge Capacity: <http://www.bt.cdc.gov/masscasualties/surgecapacity.asp> ; and  
<http://www.bt.cdc.gov/masscasualties/capacity.asp>  
Pediatric Hospital Surge Capacity: <http://www.ahrq.gov/prep/pedhospital/>

### **AEROSPACE AND AVIATION MEDICINE AND PATIENT TRANSPORT**

Aerospace Medical Resources: [http://aeromedical.org/Links/avmed\\_links.html](http://aeromedical.org/Links/avmed_links.html)  
Aviation Medicine (Pt factors): <http://emedicine.medscape.com/article/810246-overview>

Aviation Medicine Resources: [http://www.nh-tems.com/Aviation\\_medicine.html](http://www.nh-tems.com/Aviation_medicine.html)  
Flight Medic Resources: <http://www.flightweb.com/glinks/index.php?category=2>

#### **ALTERNATIVE MEDICINE**

Center for Complementary and Alternative Medicine: <http://nccam.nih.gov/>  
Center for Traditional Medicine: <http://www.who.int/medicines/areas/traditional/collabcentres/en/>  
Traditional Medicine Programs: <http://www.arctichealth.org/tm.php> ; and  
<http://americanindianhealth.nlm.nih.gov/trad-healing.html>  
Ethno-botanical Resource Directory: <http://www.cieer.org/directory.html>  
Ethno-medicine Links: <http://www.ethnomedico.com/english/links.htm> ; and <http://www.univie.ac.at/ethnomedicine/>  
Ethno-pharmacology Resources: <http://medicinus.info/research/areas/ethnopharmacology/>  
Herbals: <http://www.botanical.com/botanical/mgmh/comindx.html>  
Indigenous and Traditional Medicine Links: <http://hsclibrary.uchsc.edu/strauss#s14>  
Natural Medicines Comprehensive Database: <http://www.naturaldatabase.com/>  
Psychoactive Substances: <http://www.ethnopharmacology.com/>; and <http://www.erowid.org/psychoactives/psychoactives.shtml>

#### **CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND HAZARDOUS MATERIALS (CBNRE)**

Bioterrorism Emergencies Preparedness and Response: <http://www.bt.cdc.gov/bioterrorism/>  
Chemical Emergencies Emergency Preparedness and Response: <http://www.bt.cdc.gov/chemical/>  
Radiation Emergencies Emergency Preparedness and Response: <http://www.bt.cdc.gov/radiation/>  
CBNRE Information & Analysis Center: <http://www.cbiac.apgea.army.mil/>  
Food Safety, Animal and Plant Health Portal: <http://www.ipfsaph.org/En/default.jsp>  
Hazardous Materials Database: <http://www.cameochemicals.noaa.gov/>  
Poison Control: <http://www.aapcc.org/DNN/>  
Poison Plants Database: [http://www.cbif.gc.ca/pls/pp/poison?p\\_x=px](http://www.cbif.gc.ca/pls/pp/poison?p_x=px)  
Toxicology Databases: <http://www.atsdr.cdc.gov/toxpro2.html>

#### **DENTAL**

Dental Emergencies: <http://www.webmd.com/oral-health/guide/handling-dental-emergencies>  
Dental Emergencies and Injuries: <http://www.ada.org/public/manage/emergencies.asp>  
Dental Disease and Trauma Research: <https://www.usacc.org/research/DentalDisease.jsp>

#### **DERMATOLOGY**

Atlas of Dermatology: <http://www.brooksidepress.org/Products/OperationalMedicine/DATA/operationalmed/Manuals/GMOManual/clinical/Dermatology/AtlasofDermatology.htm>  
Dermatology Links and Resources: <http://www.hsc.stonybrook.edu/som/dermatology/links.cfm>  
Global Skin Atlas: <http://www.globalskinatlas.com/diagindex.cfm>

#### **DISASTER MEDICINE AND MANAGEMENT**

Centers for Disaster Medicine: <http://hsc.unm.edu/som/cdm/index.shtml> ; <http://www.gwemed.edu/1189844732663.html> ; and  
<http://www.mcg.edu/ems/COM/Disaster/>  
Civil-Military Guidelines for Complex Emergencies: <http://ochaonline.un.org/cmcs/guidelines>  
Complex Emergencies: <http://www.certi.org/> ; <http://www.cedat.be/> ; and  
[http://www.the-ecentre.net/resources/e\\_library/doc/OECD.pdf](http://www.the-ecentre.net/resources/e_library/doc/OECD.pdf)  
Disaster and Pre-Hospital Medicine: <http://pdm.medicine.wisc.edu/home.html>  
Centers for Disaster and Humanitarian Assistance: <http://www.cdham.org/> ; <http://www.cdmha.org/Resources.htm> ; and  
<http://coe-dmha.org/>  
Disaster Medicine Links: <http://pdm.medicine.wisc.edu/links.html>  
Disaster Management Toolkit: [http://www.hsc.usf.edu/nocms/publichealth/cdmha/toolkit\\_dm/Index\\_English.pdf](http://www.hsc.usf.edu/nocms/publichealth/cdmha/toolkit_dm/Index_English.pdf)  
Disaster Reduction Resources: <http://www.unisdr.org/>  
Non-Traditional Partners in Disaster Response: <http://rem.sed.gov/views/documents/TapIn2CommunityPartners4ERMgmt.pdf>

#### **DIVING AND HYPERBARIC MEDICINE**

Diver's Alert Network: <http://www.diversalertnetwork.org/>  
Diving Medicine Links: <http://scuba-doc.com/lnks.html>  
Diving Diseases Research Center: <http://www.ddrc.org/>  
Diving Medicine Symptoms and Treatment: <http://scuba-doc.com/sitemap.html>  
Hyperbaric Medicine Links: <http://www.scuba-doc.com/hbolnks.htm> ; and  
<http://www.virtual-anaesthesia-textbook.com/vat/hyperbaric.html>

## **EMERGENCY MEDICINE (INTERNATIONAL)**

Center for International Emergency Medicine: <http://www.iemh.org/>

Links and Resources: <http://www.acep.org/ACEPmembership.aspx?id=25148>

## **ENVIRONMENTS, ENVIRONMENTAL HEALTH AND MEDICINE**

Environmental Health Links: <http://www.sis.nlm.nih.gov/enviro/envirohealthlinks.html>

Environmental Health in Emergencies: [http://www.who.int/water\\_sanitation\\_health/hygiene/emergencies/en/](http://www.who.int/water_sanitation_health/hygiene/emergencies/en/)

Environmental Medicine Links: <http://www.uib.no/isf/guide/occu.htm>

International Union for Circumpolar Health: <http://www.iuch.org/>

Maritime Medicine Center: <http://www.gwemed.edu/maritime.htm>

Medicine in Challenging Environments: <http://www.trueresearch.org/mice2009/index.aspx>

Travel Medicine Resources: <http://gorgas.dom.uab.edu/geomed/links2.html>

Neglected Tropical Diseases: <http://gnntdc.sabin.org/>

Tropical Medicine Library and Resources: <http://lib.itg.be/bibhome.htm>

Tropical Medicine Links: <http://www.astmh.org/links/index.cfm>

Wilderness Medicine Links: <http://wms.org/links/interest.asp>

## **GEOSPATIAL HEALTH RESOURCES**

Geospatial Mapping: <http://www.cdc.gov/nchs/gis.ht> ; <http://datawarehouse.hrsa.gov/> ; and

[http://www.who.int/health\\_mapping/en/](http://www.who.int/health_mapping/en/)

## **HUMANITARIAN ASSISTANCE**

Emergency Nutrition Network: <http://www.enonline.net/>

Global Humanitarian Studies Links: <http://www.sipa.columbia.edu/academics/concentrations/ha/ghsi/introduction.html>

Global Health Cluster Response Toolkit: <http://www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=75>

Interagency Standing Committee for Humanitarian Aid Response: <http://www.humanitarianinfo.org/iasc/pageloader.aspx>

Relief Web Library: <http://www.reliefweb.int/rw/lib.nsf/doc205?OpenForm>

UN Humanitarian Information Management Toolbox: <http://www.humanitarianinfo.org/IMToolbox/>

## **IMPROVISED MEDICINE**

Improvised Medicine: <http://www.paladin-press.com/category/s>

Midwives Handbook: [http://www.hesperian.org/Publications\\_and\\_Resources.php](http://www.hesperian.org/Publications_and_Resources.php)

Where There is No Doctor: <http://www.healthwrights.org/books/WTINDonline.htm>

Where There is No Dentist: <http://www.healthwrights.org/books/WTINDentistonline.htm>

Where Women Have No Doctor: [http://www.hesperian.org/Publications\\_and\\_Resources.php](http://www.hesperian.org/Publications_and_Resources.php)

Where There Is No Psychiatrist: [http://www.asksource.info/pdf/30256\\_where\\_there\\_is\\_no\\_psych\\_ch3\\_2003.pdf](http://www.asksource.info/pdf/30256_where_there_is_no_psych_ch3_2003.pdf)

## **INFECTIOUS DISEASES**

Center for the Control of Infectious Diseases: <http://www.cdc.gov/ncpcid/>

Communicable Disease Control in Emergencies: [http://whqlibdoc.who.int/publications/2005/9241546166\\_eng.pdf](http://whqlibdoc.who.int/publications/2005/9241546166_eng.pdf)

Disease Control Priorities Project: <http://www.dcp2.org/main/Home.html>

Global Viral Forecasting Initiative: <http://gvfi.org/index.html>

Outbreaks and Surveillance: <http://www.who.int/csr/don/en>

Wildlife Disease Information Node: <http://wildlifedisease.nbii.gov/>

Zoonotic, Vector Borne & Enteric Disease Center: <http://www.cdc.gov/nczved/>

## **INTERNATIONAL, CROSS-CULTURAL AND PUBLIC HEALTH**

Cross Cultural Healthcare Program <http://www.xculture.org/>

Cross Cultural Medicine Resources: <http://www.ethnomed.org> ; and

<http://medicine.ucsf.edu/resources/guidelines/culture.html>

Global Health Office (CDC): <http://www.cdc.gov/cogh/index.htm/>

Global Health Office (Issues & Resources): <http://www.globalhealth.gov>

Global Public Health References: <http://www.pbs.org/wgbh/rxforsurvival/resources.html>

International Medicine Programs: <http://www.gwemed.edu/1189932253869.html>

Public Health Association Resources: <http://www.apha.org/programs/resources/>

Public Health Preparedness Centers: [http://www.asph.org/cphp/cphp\\_home.cfm](http://www.asph.org/cphp/cphp_home.cfm)

Public Health Links: <http://www.sph.emory.edu/PHIL.php>



## **LABORATORY**

Clinical Lab Science Resources: <http://members.tripod.com/~LouCaru/index-5.html>

Laboratory Links: <http://wwwn.cdc.gov/nltm/mltl.aspx>

## **MASS CAUSALITIES**

Community Based Mass Prophylaxis: <http://www.ahrq.gov/research/cbmprophyl/cbmpro.htm>

Mass Care and Shelters Guide: <http://www.cdsscounties.ca.gov/coplanners/>

Mass Causality & Refugee Evacuation: <http://www.ahrq.gov/prep/natlsystem/>

Mass Causality Resources: <http://www.bt.cdc.gov/masscasualties/>

National Mass Fatalities Institute: <http://www.nmfi.org/>

## **MATERNAL-CHILD HEALTH**

Antenatal Guidelines for Crisis Conditions: <http://www.icrc.org/web/eng/siteeng0.nsf/html/p0875>

Maternal/Child Health Resources: [http://www.who.int/making\\_pregnancy\\_safer/publications/en/](http://www.who.int/making_pregnancy_safer/publications/en/)

## **MENTAL HEALTH**

Mental Health Resources: <http://www.bt.cdc.gov/mentalhealth/>

Disaster Mental Health Resources: <http://www.trauma-pages.com/disaster.php>

International Mental Health and Resources: [http://www.iop.kcl.ac.uk/international/?project\\_id=80](http://www.iop.kcl.ac.uk/international/?project_id=80)

## **MORGUE AND REMAINS MANAGEMENT**

Disaster Victim Identification Guide: <http://www.interpol.int/Public/DisasterVictim/guide/default.asp>

Disaster Morgue Operations: <http://www.winid.com/dmort7/Final%204-WHITE.doc>

Management of Human Remains: <http://www.icrc.org/web/eng/siteeng0.nsf/html/p0858>

## **NEUROLOGY**

Traumatic Brain Injuries: <http://www.neure.com/> ; and <http://www.mayoclinic.com/health/traumatic-brain-injury/DS00552>

## **OBSTETRICS AND GYNECOLOGY**

Reproductive Health Care in Emergencies: [http://www.who.int/reproductivehealth/pages\\_resources/listing\\_emergency.en.html](http://www.who.int/reproductivehealth/pages_resources/listing_emergency.en.html)

## **OPERATIONAL MEDICINE CENTERS**

<http://www.mcgm.edu/ems/COM/> ; <http://www.gwemed.edu/1193734316069.html> ;

<https://www.momrp.org/> ; and <http://www.med.navy.mil/sites/navmedmpte/nomi/Pages/default.aspx>

## **OPHTHALMOLOGY**

American Academy of Ophthalmology Resources: <http://www.aao.org/>

Eye Disorders Online: <http://www.merck.com/mmpe/sec09.html> and <http://www.opthalmologyweb.com/default.aspx>

## **PATHOLOGY**

Armed Forces Institute of Pathology: <http://www.afip.org/>

Investigative Pathology: <http://www.asip.org/>

Pathology Links: <http://www.asip.org/links/biomedical.htm>

## **PEDIATRICS**

Child Health in Emergencies: <http://www.who.int/child-adolescent-health/publications/pubemergencies.htm>

Pediatric Immunization Guide: <http://aapredbook.aappublications.org/current.shtml>

Pediatric Patient Management: <http://practice.aap.org/topicBrowse.aspx?nodeID=4000>

Pediatric Resources: <http://pages2.inrete.it/mbiomed/pedi.htm> ; and <http://www.lib.uiowa.edu/hARDIN/MD/ped.html>

## **PHARMACOLOGY**

Essential Medicines: <http://www.who.int/medicines/publications/en/>

Merck's Clinical Pharmacology: <http://www.merck.com/mmpe/sec20.html>

Psychopharmacology Resources: <http://www.ascpp.org>

## **RADIOLOGY AND MEDICAL IMAGING**

Med Pix Medical Image Database: <http://rad.usuhs.edu/medpix/index.html>

Radiology Education Gateway: <http://tmcr.usuhs.mil/>

Radiology Links and Resources: <http://www.radiologyeducation.com/>

Public Health Image Library: <http://phil.cdc.gov/Phil/home.asp>

## **REFUGEE MANAGEMENT**

Center for Refugee and Disaster Medicine: <http://www.jhsph.edu/refugee/>

Refugee Decision Support Resources: <http://www.unhcr.org/cgi-bin/tehis/vtx/refworld/rwmain>

Humanitarian Aid Links: <http://www.unhcr.org/cgi-bin/tehis/vtx/reflink/download.htm>

Refugee Resources: <http://www.unhcr.org/cgi-bin/tehis/vtx/reflink>

## **SURGERY**

Integrated Management Tools for Essential and Emergency Surgical Care:

<http://www.who.int/surgery/publications/imeesc/en/index.html>

Surgical Care in Emergencies: [http://www.who.int/surgery/en/ESC\\_in\\_disasters.pdf](http://www.who.int/surgery/en/ESC_in_disasters.pdf)

Surgical Care at the District Hospital: <http://www.who.int/surgery/publications/en/SCDH.pdf>

Surgery for Victims of War: <http://www.icrc.org/web/eng/siteeng0.nsf/html/p0446>

## **TACTICAL MEDICINE**

Tactical Medicine Centers: <http://www.mcg.edu/ems/COM/Tactical/> ; and <https://www.usacc.org/index.jsp>

## **VETERINARY MEDICINE**

Animal Disease Alerts, Information and Resources: [http://www.oie.int/eng/en\\_index.htm](http://www.oie.int/eng/en_index.htm)

Animal/Plant Health Inspection Service and Resources: <http://www.aphis.usda.gov/>

Bio-security Center for Animal Health Emergencies: <http://www.biosecuritycenter.org/>

Diagnostic Tests and Vaccines for Terrestrial Animals: [http://www.oie.int/eng/normes/mmanual/A\\_summry.htm](http://www.oie.int/eng/normes/mmanual/A_summry.htm)

Global Early Warning System for Animal Diseases: <http://www.who.int/zoonoses/outbreaks/glews/en/index.html>

Veterinary Resources: <http://informatics.vetmed.vt.edu/Projects.htm>

Veterinary Emergency and Critical Care Links: <http://veccs.org/>

Veterinary Environmental Health Center: <http://www.emc.ncsu.edu/>

Veterinary Public Health and Zoonotic Disease: <http://www.who.int/zoonoses/vph/en/>

Wildlife Disease Information Node: <http://wildlifedisease.nbi.gov/>

World Veterinary Association Links: [http://www.worldvet.org/Web\\_Links.html](http://www.worldvet.org/Web_Links.html)

## Photo Gallery



A 11 year old boy whose tibia continued growing after a below knee amputation. He originally had his right great toe amputated due to infection. A year later his right foot had to be amputated due to infection. A few months later he received a BKA. His family chose not to make the three day travel to Kabul for any more surgeries so they washed his bandages for two years while the tibia continued growing and punched through his skin. An 18D whose habit was to inspect and redress any bandages he saw found this stump. He coordinated to have the boy and his father flown to Bagram where he was operated on by American surgeons. Three months later the boy was fitted for a prosthetic leg. A year later he was seen again, walking fine, no infection and probably the happiest Afghan in Paktika Province.

*Photo courtesy of Victor Andersen*



While watching vehicles outside of a Shura meeting in Paktika Province, Afghanistan, an 18D treats fresh wounds on a little girl who refused to identify who had beaten her up.

*Photo courtesy of Victor Andersen*



A 5-year-old boy had been burned while filling his family's woodstove. He was treated five days in a row by an 18D doing "Tailgate Sickcall" in Orgun, Afghanistan.

*Photo courtesy of Victor Andersen*





An Afghan had been shot in the arm, chest, and head. He was treated and saved by an 18D who performed a tube thoracostomy and cricothyroidotomy while awaiting CASEVAC.

*Photo courtesy of Victor Andersen*



While the rest of the team searches a compound, an 18D conducts sick call on civilians in an effort to maintain rapport and justify the Americans' presence.

*Photo courtesy of Victor Andersen*



An 18D does a physical exam and deworms one of his favorite Afghans.

*Photo courtesy of Victor Andersen*



A child lame since age three is brought to the team medic. The medic was able to get the boy a wheelchair but no miracle cure.

*Photo courtesy of Victor Andersen*



Col (Dr) Gary Geracci-Oral & Maxillofacial Surgeon-USS-COM CEB and MSgt Rodolfo Palacios-Aeromedical Technician 99MDG suture a scalp laceration on a young boy during a Humanitarian med mission in Nicaragua.

*Photo courtesy of Col Gary Geracci*



# *Meet Your JSOM Staff*

## **EXECUTIVE EDITOR**

Virgil T. Deal, MD, FACS

Virgil.Deal@socom.mil



Prior to becoming the USSOCOM Command Surgeon, COL “Tom” Deal served in staff positions at USASOC, JSOC, 7th SFG, and XVIII Airborne Corps. He has commanded field and stateside hospitals and served as Chief of Surgery in the 86th Evac Hospital in ODSS and at Army and civilian community hospitals.

COL Deal obtained his medical degree from University of Tennessee College of Medicine, Memphis, Tennessee, 1974. He completed his general surgery residency at Brooke Army Medical Center 1977-1981 and is certified by the American Board of Surgery.

COL Deal completed his Flight Surgeon’s Course – 2003, Army War College – 1997, Command & General Staff College – 1994, AMEDD Officer Advanced Course – 1991, Military Free Fall School – 1977, Special Forces Officers Course – 1976, and Airborne School – 1975.

COL Deal has also completed Combat Casualty Care Leadership Course (C4A) –1991, Pre-Command Course, Fort Leavenworth – 1994, Senior Officer’s Legal Orientation, Charlottesville -- 1994, Combatant Commander’s Surgeons Course – 1996, AMEDD Pre-Command Course, Fort Sam Houston – 1998, Basic Life Support – current, Advanced Cardiac Life Support, Advanced Trauma Life Support, and Pilot, single engine, land, instrument.

## **MANAGING EDITOR**

Michelle DuGuay Landers, RN

duguaym@socom.mil



Lt Col Landers joined the Army Reserve in 1987 and served as a nurse in a Combat Support Hospital unit for three years before switching services in 1990 to become an Air Force C-130 Flight Nurse. She is currently an IMA reservist attached to the SOCOM/SG office where she has been in charge of management, production, publication, and distribution of the JSOM since its inception in Dec 2000. Lt Col Landers has a Bachelors in Nursing and a Masters in Business Administration/Management. Her 23 year nursing career includes being a flight nurse in both the military and private sector, 15 years of clinical experience in emergency and critical care nursing as well as being an EMT and a legal nurse consultant. She also served as the military liaison to the FL 3 Disaster Medical Assistance Team (DMAT). Prior to the SG office, Lt Col Landers’ experience at USSOCOM includes an assignment in the Center for

Force Structure, Resources, Requirements, and Strategic Assessments.

## Submission Criteria

1. Use the active voice when possible. This is our most common editorial problem and often requires extensive re-writes. Use the sequence “subject - verb - object.”
2. Secure permission before including names of personnel mentioned in your piece. Do not violate copyright laws. If the work has been published before, include that information with your submission.
3. Format articles to be single-spaced, eleven point Times Roman font, aligned on the left, and justified on the right. Double space between sentences.
4. **Important:** Include an abstract, biography, and headshot photo of yourself as part of the article. Important: Include an abstract, biography, and headshot photo of yourself as part of the article. Include three learning objectives and ten test questions if article is submitted for continuing education.
5. Use a minimum of acronyms; spell out all acronyms when first used. Remember that your audience is inter-service, civilian, and international.
6. Put the point of the article in the introductory paragraph and restate it in the closing or summary. Subtlety is not usually a virtue in a medical publication.
7. We do not print reviews of particular brands of items or equipment unless that brand offers a distinct advantage not present in other products in the field. The author must specify in the article the unique features and advantages the product offers in order to justify an exception to this rule. The author must also specify whether the article was purchased by him or his unit, or supplied for free by the seller or manufacturer. Finally, the author must disclose any relationship with the manufacturer or seller, whether financial, R&D, or other.
8. Cite all references in chronological order. **DO NOT insert footnotes or use roman numerals.** Give the full name of the journal, book, or website cited. Use the following style of citation when referencing a **Journal article** - Vogelsang, R. (2007). Care of the military working dog by medical providers. *Journal of Special Operations Medicine*; 7(2)(Spring):33-47. **Newspaper article** - Di Rado, A. (1995, March 15). Trekking through college: Classes explore modern society using the world of Star Trek. *Los Angeles Times*, p. A3. **Book article or chapter** - Giger, Urs (2000). Blood typing and crossmatching to ensure compatible transfusions. In John Bonagura Ed. *Kirk's Current Veterinary Therapy XIII Small Animal Practice*. Philadelphia, WB Saunders Co. 2000, p. 140-147. **Website** - Miles, D. (2004, Sep. 3), Military working dogs protect Forces, bases during terror war. Armed Forces Press Service. Retrieved July 1, 2008 from Defense Link website. Website: <http://www.defenselink.mil/news/newsarticle.aspx?id=25393>. If unsure, please contact us at [jsom@socom.mil](mailto:jsom@socom.mil).
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### Special Forces Aidman's Pledge

As a Special Forces Aidman of the United States Army, I pledge my honor and my conscience to the service of my country and the art of medicine. I recognize the responsibility which may be placed upon me for the health, and even lives, of others. I confess the limitation of my skill and knowledge in the caring for the sick and injured. I promise to follow the maxim "Primum non nocere" ("First, thou shalt do no harm"), and to seek the assistance of more competent medical authority whenever it is available. These confidences which I will treat as secret. I recognize my responsibility to impart to others who seek the service of medicine such knowledge of its art and practice as I possess, and I resolve to continue to improve my capability to this purpose. As an American Soldier, I have determined ultimately to place above all considerations of self the mission of my team and the cause of my nation.



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### Pararescue Creed

I was that which others did not want to do, I did what others failed to do. I asked And reluctantly accepted the I fail. I have seen the face of terror; joyed the sweet taste of a moment's hoped...but most of all, I have lived ten. Always I will be able to say, that my duty as a Pararescueman to save a my assigned duties quickly and efficiently, placing these duties before personal desires and comforts.



be. I went where others feared to go, and nothing from those who gave nothing, thought of eternal loneliness ... should felt the stinging cold of fear, and en-love. I have cried, pained and times others would say best forgot-I was proud of what I was: a PJ It is life and to aid the injured. I will perform

These things I do,  
"That Others May Live."

### A Navy Poem

*I'm the one called "Doc"... I shall not walk in your footsteps, but I will walk by your side. I shall not walk in your image, I've earned answered the call together, on sea for help was given, I've been on the ocean or in the jungle wear-man, be it Sailors or Marines. and you think of calling him "squid," him did. And if you ever have to go out there and your life is on the block, Look at the one right next to you...*



*my own title of pride. We've an-and foreign land. When the cry there right at hand. Whether I am ing greens, Giving aid to my fellow So the next time you see a Corpsman think of the job he's doing as those before*

*I'm the one called "Doc".*

*~ Harry D. Penny, Jr. USN Copyright 1975*



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